



FRIDAY, JANUARY 31, 1879.

Chambers' Pneumatic Signals.

With the increase of traffic and the number of trains and the demand for higher speed on our railroads, the block system will become a necessity, and the time does not seem to be far off when the managers of many of the lines in this country will be obliged to adopt some appliances for running their trains on that system. To such persons the apparatus which we illustrate herewith, which is the invention of Mr. Austin Chambers, and which is now in successful use on a number of English roads, including the Metropolitan (underground) of London, will be of great interest.

The signal used is the ordinary semaphore, represented in fig. 3, which is used in Europe and the merits of which, it may be added, have never been generally recognized in this country. Mr. Chambers' invention consists, first, in appliances for operating these signals by compressed air, and second, in an instrument which renders it impossible for a signal-man to lower his signal to indicate line clear and allow a

train to pass until he has received notice from the signal station ahead of him that the line is clear.

Fig. 1 represents a section of a portion of a signal cabin, in which the signal-man occupies the upper story, above the floor *K*. *A A'* is a right-angled lever, pivoted at *a'* and con-

ected by a rod, *b b'*, having an arm, *d*, with an air compressor, *B* (shown in larger scale in fig. 2). These compressors are made of india-rubber cylinders, similar to the bags used with Smith's vacuum brake, or to the bellows of an accordion. When the signal lever *A* is pulled over into the position indicated by the dotted lines *a a'*, it is evident that the lower end of the india-rubber cylinder will be raised up and the air in it will be compressed and will pass into the pipe *C*, which is connected with the vertical pipe *C'*. The upper end of this pipe communicates with the instrument *G*, the action of which will be explained presently; the lower end, *C' C''*, connects with the pipe *C' C''*, attached to the signal post, fig. 4, and with another rubber cylinder, *E*, attached to the post by a bracket, and having its lower end connected by a rod, *h*, to the semaphore arm *F*. This arm is counterweighted at *L*, so that it will, by its own gravity, fall into the horizontal position shown. It is evident now that if the pipe *C' C''* is filled with compressed air, which can flow into the cylinder *H*, the lower head will be pressed downward and the arm *F* will be pulled down by the rod *h*. To allow the semaphore to resume its "danger" position, the lever *A*, fig. 1, is thrown over again into the position shown in the engraving, when the pressure in the compressor *B*, and in the pipes *C' C''*, again becomes the same as that of the atmosphere.

The U-shaped glass tube *H* contains water, and, having one end communicating with the pipe *C*, indicates by the height of the column the pressure of the air. The telegraph indicator *I* is in electrical communication with the instrument *G* and the station ahead, showing when the line is clear.

The most essential part of the whole invention, however, for the block system, is the instrument *G*, shown in fig. 1, and again on a larger scale in fig. 5. The object of this, as already explained, is to make it impossible for the signal-man to lower his signal to indicate line clear until he has received notice from the signal-man at the station ahead of him that the line is clear. This instrument, fig. 5, consists of a tube, 5, connected at its upper end, *C*, with the tube *C'*, fig. 1, and having its lower end closed by a valve, 4, attached to a lever, 3 3', which is pivoted at 3 and has an armature, 2, at the opposite end. 1 is an electro-magnet, which is made magnetic by passing a current of electricity through its coils. When this is done, it attracts the armature 2, and closes the valve 4. So long as the valve remains open, the compressed air in the pipe *C' C''*, fig. 1, will escape at 4, and any attempt on the part of the signal-man to move over the lever *A*, will simply result in forcing the air through the valve 4, and it will, therefore, be impossible to lower the signal. The magnet 1 is connected by a wire with the station ahead, and the only way in which the valve 4 can be closed, is by the action of the signal-man at that station, who is provided with the proper instruments for passing a current of electricity through the wire and magnetizing 1, and thus closing the valve 4. When this is done, and not until then, can the semaphore be lowered to "clear line." It will thus be seen that the signal-man at one station is entirely dependent upon the signal-man ahead of him, and that it is impossible to give the signal of "line clear" without the cooperation of both. It will readily be understood, too, that if any accident happens to the apparatus by leakage or otherwise, the signals must remain at their normal or danger position.

The lamp represented in fig. 4 is very simple; *a a'* is a casing of sheet-iron having two lenses, *A* and *B*, the top one representing "line clear," the bottom one "danger;" half-way up this cylinder is a diaphragm or division, *b*, with a hole in its centre. In the lower division is a collapsible rubber bag, *D*, carrying a gas-jet, *C*, connected to the gas main by a flexible tube. Without pressure in this bag the light shines through the lower or "danger" lens, *B*; when compressed air is admitted into it, it expands, carrying the gas-jet through the hole into the upper or "safety" compartment.

Mr. Tomlinson, engineer of the Metropolitan Railway, of London, has used this system of signals for the last three years and speaks very highly of it, saying that it gives "perfect satisfaction."

Mr. Harry Olrick, an English engineer, is now visiting this country with a view of introducing it here. His address is No. 111 Broadway, room 110, New York.

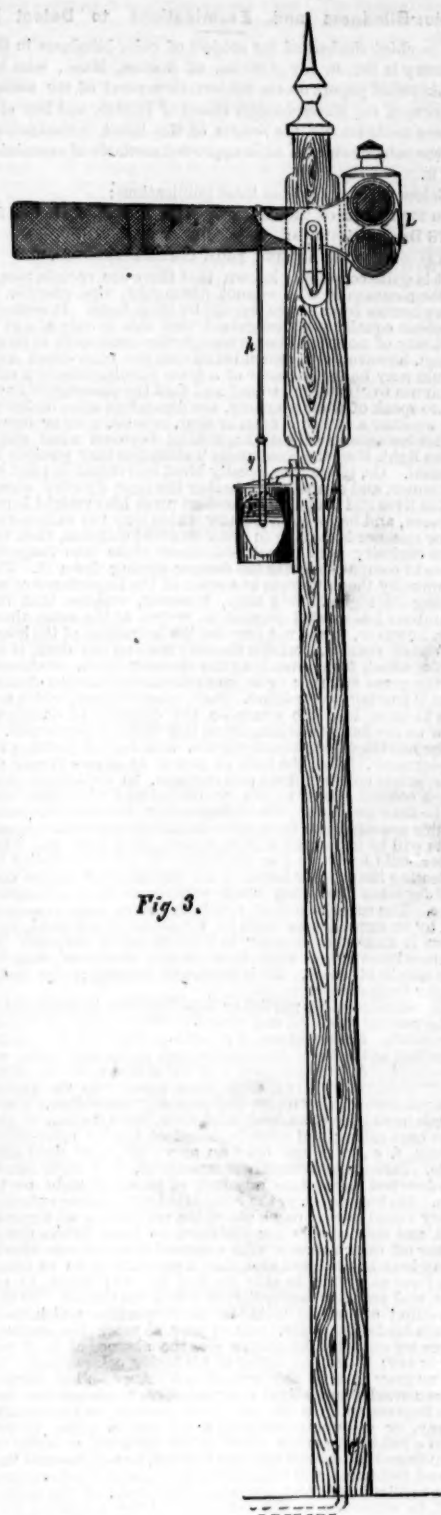


Fig. 3.

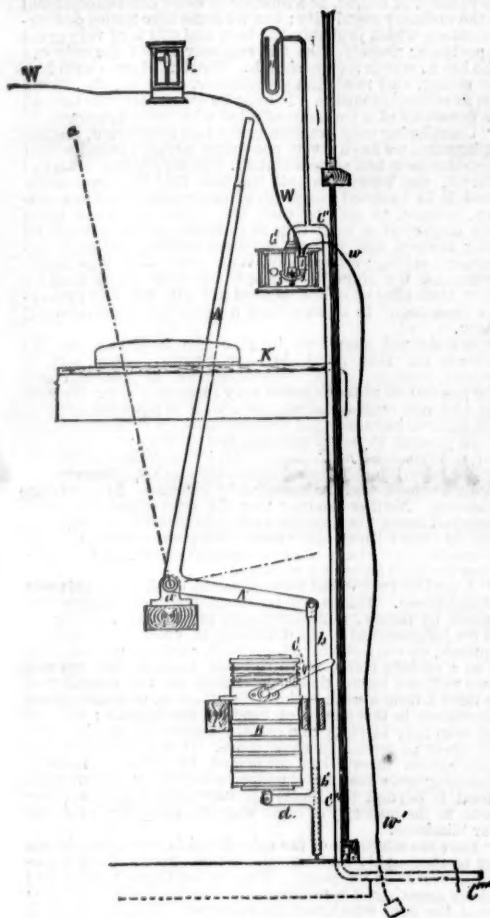


Fig. 1.

train to pass until he has received notice from the signal station ahead of him that the line is clear.

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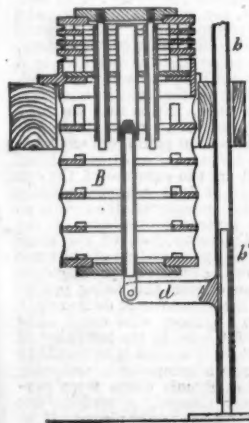


Fig. 2.

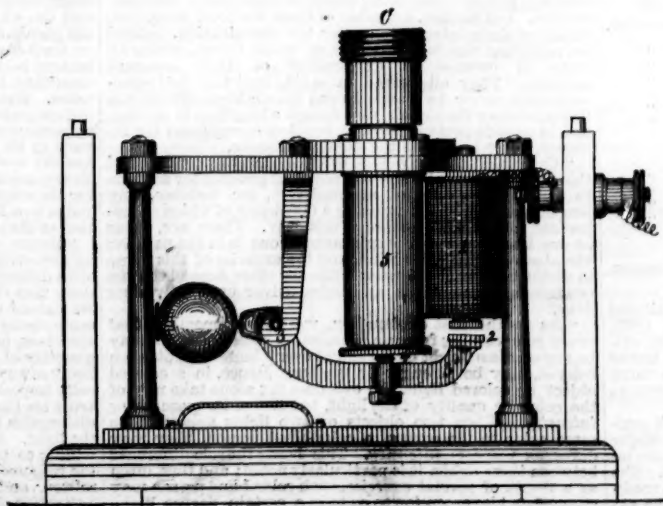


Fig. 5.

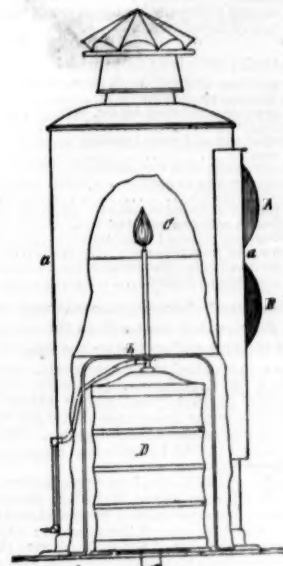


Fig. 4.

Color-Blindness and Examinations to Detect It.

The chief student of the subject of color-blindness in this country is Dr. B. Joy Jeffries, of Boston, Mass., who has contributed papers on the subject to several of the annual reports of the Massachusetts Board of Health, and has elsewhere made known the results of the latest investigations of the subject and the most approved methods of examining for it.

Below we compile from these publications:

In the report of the Massachusetts Board of Health for 1878 Dr. Jeffries says:

DANGERS ARISING FROM COLOR-BLINDNESS.

It is quite commonly known that there are certain people in the community who cannot distinguish ripe cherries or strawberries from leaves, except by their form. It seems to be about equally well recognized that this is only a sort of curiosity of no special importance to the community at large. When, however, it is remembered that the color-blind individual may be the engineer of a train running nearly a mile a minute to "catch up time," and that the passengers' lives, not to speak of their property, are dependent upon his knowing whether a switch is open or shut, or a draw up or down, by his instantaneously distinguishing between a red and a green light, then the community's attention may possibly be aroused. Or, if another equally blind individual is pilot on a steamer, and cannot say whether the light directly ahead of the lives and property dependent upon his eyesight is red or green, and hence cannot know which way the sailing-vessel or steamer is moving in order to avoid collision, then the mere curiosity part of color-blindness sinks into insignificance in comparison with the danger arising from it. The community then awakens to a sense of the importance of ascertaining its rights. We may, however, suppose that the steamboat has several persons on watch at the same time. This, however, would not prevent the helpman of the heavily-loaded coaster, perhaps the only man on the deck, if he is color-blind, from mistaking the steamer-lights, confounding the green and red; or he may miscalculate their distance, if he is partially color-blind. Such cases as these, which are sure to come into the courts on the question of damages, show us the dangers arising from this visual imperfection.

The mortification, inconvenience, and loss of position or employment, from the lack of power to choose proper or appropriate colors in dress and costume, to distinguish and match colored goods, to mix or use colored pigments, will not be here dwelt on. The dangers only to which the community are subjected from color-blind railroad employes and pilots will be explained in this article, and how and why these should be avoided by the action of the community in protecting itself. For instance, an engineer has run on one road for some five or ten years without accident of importance. The superintendent requires him to pass examination by an expert, who finds he is markedly red-blind, and shows it most convincingly to the officials of the road. It becomes known; and they then do not, of course, dare to keep him in his place. He is dismissed, to protect the community from danger.

Color-blindness is a partial or total inability to appreciate, as the normal eye does, one or more of the three so-called base colors. Scientists are at present pretty well agreed in regarding as the three base colors, red, green and violet, or blue-violet. A large proportion of those who are color-blind are so in reference to red; next come those who are green-blind; and but rarely do we find persons violet-blind. Individuals have been examined who were blind to two of the three base colors; and there is record of totally color-blind persons, i. e., who had only an appreciation of light and shade. It must be distinctly remembered, that color-blindness does not necessitate any lack of power of sight as to form. On the contrary, the color-blind may possess extraordinary visual power, much above the normal eye as regards form, and may be able, for instance, to read letters much farther off than a person with a normal eye, not color-blind. It may here be observed also, that a person may be so blind as to form as not to be able to find his way about, or go alone, and yet have perception of colors and shades. To the color-blind all mixed tints, in the proportion which they contain his faulty color, will appear so much the darker. Where we see color, he simply sees the absence of it, if we may so say; that is, an object of his faulty color appears to him as gray does to the normal eye. A red-blind person places a scarlet and a light gray together, as giving him the same impression. He will put on red pants or vest as readily as gray, or wear complacently a red and a green glove. When a red-blind person looks at the spectrum, or series of colors from light passed through a prism, he will, toward the red end, fail to see any color where the normal eye continues to see brilliant red; and the same will hold of the violet-blind, in reference to the other end of the spectrum, etc. This has an important bearing on the danger from color-blindness, as we shall hereafter see. A person who is red-blind cannot distinguish that color from green; or, if blue-violet-blind, that color from yellow; or, if green-blind, that color from its complementary one, red. Hence we have practically to deal with red-green blindness and blue-yellow blindness. These are, however, the very colors of necessity used on our railroads, sailing-vessels and steamboats, as well as in many lighthouses.

Statistics are given from which it appears that out of

150 students at Edinburgh, there were.....	1 in 50	color-blind.
158 Edinburgh policemen.....	1 in 31.6	"
1,154 persons examined by Dr. Wilson.....	1 in 17.7	"
800 reported by Dove.....	1 in 21.5	"
1,010 students at Lyons Lyceum.....	1 in 33.5	"
611 women.....	1 in 12.2	"
1,106 men examined for railroad.....	1 in 83.4	"
224 conductors in service.....	1 in 16	"
75 office clerks.....	1 in 184	"
1,084 Danish railroad employes.....	1 in 35	"
2,300 Dutch railroad employes.....	1 in 15	"
400 German railroad employes.....	1 in 60%	"
1,312 men in Austrian navy.....	1 in 21	"
8,831 men in United States army.....	1 in 55	"
611 students in Boston.....	1 in 20	"

* The method of examination was very imperfect.

Dr. Jeffries then quotes from the Swedish Dr. Holmgren, one of the first authorities on the subject, as follows:

"In a case called the Lagerlunda, arising from a railroad accident at Lagerlunda, in Ostrogothie, Nov. 15, 1875, and which excited great public attention, there was evidence leading me to suppose that color-blindness was one of the principal causes of the disaster. This led me to think that control should be exercised among railroad employes as to color-perception.

"In June, 1876, I had an opportunity for testing this matter. By the courtesy of Maj.-Gen. von Knorring and Major Rudbeck, I was permitted to examine 2,200 men of the infantry and dragoons of the guard in camp in Upland. The extreme simplicity of the method was shown, and its ready adaptation both as respect rapidity and certainty. The examination averaged one minute to a man, often less; and, by the improved method adopted, we detected also with certainty all those partially color-blind. From this examina-

tion we learned, in reference to the existence of color-blindness among the population of the province, that out of the 2,200 men, 11 were red-blind, 17 could not perceive green, and 1 violet (?); 31 besides were *incompletely* color-blind in accordance with my classification. There were, then, 60 defective, or 2.7 per cent. The cases of 'feeble sensation of colors' are not here included.

"July 14 of the same year, I had opportunity, at the Scandinavian Medical Congress, assembled at Gothenbourg, to describe my method, report the results of its employment, and also to express my views as to the necessity of taking measures on a large scale in reference to the detection of color-blindness, especially among railroad employes. In consequence, the Congress voted unanimously on the necessity of instituting examinations to detect color-blindness first among railroad employes, second among pilots, lighthouse-keepers and sailors in general, and third in the schools. During the Congress I had time to show the physicians the practical application of the method, by examining in their presence, by permission of Col. Carlsohn, 100 men of the artillery regiment in Götha, among whom we found 4 color-defective, 1 for red, 1 for green, and 3 incompletely blind to color. At the same time I found one green-blind among the physicians, members of Congress, and one red-blind among the assistants.

"I was then prepared to apply directly to the railroad administration. Thanks to the press, which followed attentively the discussions in the Congress of Gothenbourg, the question came to the knowledge of the public. It naturally attracted the attention of the railroad employes, who for the most part looked upon it with a certain distrust, as rather the result of learned imagination or over-solicitude, than as a practical matter for the railroad service. We have heard a railroad employe use almost literally these words: 'If color-blindness really exists, it cannot be among the employes, or it would have been noticed. This must at least be the case with the engineers and conductors, all of whom obtain their places after passing through inferior grades, and consequently after having sufficiently proved their faculty of distinguishing colors.' It was therefore very important to obtain some certain data on this point. This soon arose. Mr. Jacobson, *chef d'exploitation* of the Upsala-Göthe line, asked me to accompany him on a tour of inspection, and examine all the employes under his orders. The tour was undertaken in the fall; we left Upsala Sept. 7, and to carry out our examinations halted at all the stations, at all the guard-houses and at every gate; in short, we stopped at every point where an employe was to be found. The examination was finished at Gefle, Sept. 8. All the force, 268 men and women, were tested. Among them we found 13 defective; viz., 4.8 per cent. Six were completely green-blind, and 7 incompletely color-blind. Their positions were, 1 chief of station, 1 engineer, 3 conductors, 1 chief of equipments, 2 men of the equipment department (one a supernumerary), 2 overseers, 2 road-guards, 1 clerk and 1 stoker. Immediately after the examination, the *chef d'exploitation* dismissed all those who were blind for green.

"This first expedition was interesting in many respects. It showed that the method of examination was adapted to and could be used on the railroads. It showed, moreover, that there were really color-blind, in nearly every degree, employed on the Swedish roads, of which no one had had the slightest suspicion.

"In Finland, Dr. L. Krohn, who was by correspondence instructed in the method and principles applied in Sweden, has already examined the *personnel* attached to the railroads of his country. A locomotive and car were placed at his disposition to enable him to test the employes on the whole length of the line. It was completed in twelve days. He found, among 1,900 persons tested, 60 color-blind, namely, 5 per cent. They were as follows: 4 red-blind, 25 green-blind and 31 incompletely blind."

Professor Holmgren brought this matter before the various railroad directions in Sweden. Moreover, experiments were made in the Physiologic Institute at Upsala, so that by Nov. 9, 1878, throughout Sweden, it was ordered that all the railroad employes should be tested for color-blindness by the methods there used. What Professor Holmgren has accomplished leaves no excuse for our American railroads in hesitating or refusing to thoroughly and properly test all their employes for defects of color-perception, and dismissing those who are color-blind, and providing also for the future by testing all applicants for employment.

If long before this my readers have been astonished at the facts here collected, they no doubt have also been equally disposed to question them, or at least their practical bearing. They will naturally say: "We do not hear of railroad accidents from color-blindness, and rarely of marine collisions attributable to this cause." Of this I shall again speak, but I must first here explain how it is that the color-blind get on so well, conceal their defect and perhaps avoid accident. I shall confine my remarks to the railroad *personnel* and mariners. Professor Holmgren explains this so readily from his experience, that I do best to first quote from him.

He says:

"We should imagine a color-blind railroad employe would be immediately detected, or would have at least discovered his own defect. This very natural idea has greatly tended to retard the reform we have called for. It is, however, incorrect, and does not stand the test. On the contrary, examinations showed that a large number of color-blind were employed in nearly all the positions on a railroad, without they or others being aware of their faulty color-perception. And further, a number of these, far from being convinced of their defect, even after the examination, insisted on repeating the test (even six or seven times), giving all sorts of excuses in explanation of their constant mistakes. They all agreed in saying that they had excellent sight, never had experienced the slightest difficulty in distinguishing the signals, and though a long time in service, and in most important posts, as locomotive-engineers for instance, never had made the slightest mistake.

"Certainly we may well be astonished at this condition of things, and very naturally ask how it is possible for any one to perform the duty of engine-driver, for instance, any length of time without exposing a deficiency of vision so important for the performance of this duty. There are, so far as we know, only two explanations: one is in the peculiar visual sense of the color-blind, and the exercise of this sense in distinguishing the signals; while the other depends on the conditions under which an engine-driver ordinarily does duty.

"As to the first explanation, we must remember that every color coming from an illuminated colored surface may be more or less bright or dark, and every lantern-light, even colored, may be stronger or weaker. Hence, in a colored object or colored light, the eye does not alone take note of the color or quality of the light, but also of its *quantity* or *intensity*. When two objects or two lights appear of the same color to the eyes of a color-blind person, they may differ as respects *intensity*. This being the sole difference between these lights, it is particularly noted; and thus, often as a result of special exercise, such color-blind person may strengthen his perception so as to in a certain degree make up for his color deficiency. He resembles somewhat the persons who, deprived of one sense, replace it to a degree, by the greater exercise of one or more of their other senses.

We have already noticed this point, so very important in practice, but could not refrain from again reverting to it here. Any one who has experience from conversation with intelligent color-blind, or experimenting with Maxwell's rotating disk, will have noticed their peculiar sensitiveness to *varying intensity of light*, while comparing two colors, and hence can have no doubt as to how a color-blind person can so often distinguish between railroad signals, and give the colors their true names.

"Did we not know this, we should be greatly astonished to find with what facility a color-blind employe can distinguish between the red and green flag, and generally call the red, green and yellow lanterns by their right color; but it is the intensity of the light, and not the color, which governs his decision, and this is the whole secret. The flags and lanterns have, in fact, usually a constant difference as to intensity. The green flag is to the color-blind, as also to the normal eye, undoubtedly of the deepest or darkest color, and the red the most brilliant. As to the lanterns, the red-blind always recognize the red light by its being darker than the green, and the yellow by its being clearer or more brilliant than the other two. The green-blind finds also, in his turn, the red more brilliant than the green, and distinguishes it by this.

"The other explanation lies in the conditions under which an engineer has to observe the signals. First of all, we must remember the great regularity with which all the details of railroad service take place. An engineer starting from a station at one end of the line knows very well in advance what stations to stop at, and which to pass. Under ordinary circumstances, he knows which light ought to be exhibited on the signal-posts above the several stations. The hand-lanterns are not as important, since their color is not so essential, being supplemented by movements. Hence it is only under exceptional conditions that accidents can happen at stations, from mistakes as to the color of fixed lights. There may, of course, be a number of other cases exceptional to the ordinary regularity; but we must here notice one circumstance which probably has been and still is of very great importance; namely, that the engineer is not the only one who has to watch for the signals. There is always with him the stoker, and near him a conductor, an oiler, etc., to aid him at critical moments. It must be extremely rare that all the *personnel* of a train are affected with color-blindness.

"Considering only practically the fact mentioned, and the explanation we have given, one might perhaps imagine that color-blindness had some scientific, but hardly any practical interest, and hence that all the talk that has been made about it in railroad employes in our country was unnecessary, because, as may be said, the color-blind have often been employed a long time in railroad service without its being noticed, and without accident or the slightest inconvenience arising; and finally, that, since they can really distinguish the signals (although this is otherwise than by color), their kind of blindness need not call for any preventive measures. It is thus that a great many persons still reason.

"We do not stop here to give the testimony of experience on this point in our country. One fact is certain; namely, that color-blindness in other countries has caused numerous and very fatal accidents. Even if this had not been definitely proved, it is none the less evident that we have no right to await another such experience before passing to words and acts, and in every way showing, that, notwithstanding the numerous circumstances which assist the color-blind in responding to the signals, danger is not wholly avoided, and the uncertainty remains. This is readily shown. Neither the fact that the color-blind have been employed many years on the railroads without causing accident, or even without their defect being discovered, nor the circumstances we have cited in explanation of this fact, furnishes the least assurance of security.

"A typical color-blind person cannot distinguish between red and green. This is an incontestable fact, readily explained by theory, and sufficiently proved by experience. All his judgment as to the difference of colors rests, in consequence, on conjecture. If, perhaps, exercise enables him, up to a certain point, to distinguish between the red and green railroad lights, this is dependent on the intensity of the light telling him the color. But there is, of course, great uncertainty in this means of reading the signals; and the man who may be right in a certain number of special cases will surely go wrong in some other. It is a principle not dependent on theory, but confirmed by our experience in examining more than two hundred color-blind; and we may extend it beyond the limits we have here kept—in other words, to the majority of cases also of *incomplete* or *partial* color-blindness.

"That the situation of the color-blind in respect to signals may be thoroughly understood, we must here add a few important words on the point. What is the intensity of light? Strictly speaking, it is nothing but the force of the impression of the light which our eye receives. This, however, is dependent on two factors: one, the quantity of light radiating from the object observed or reflected by it; the other, the strength or amount to which the eye reacts to this, or, in other words, the sensibility of the subjected visual sense. We may readily understand that both of these factors are extremely variable under the circumstances of the engineer's service. The amount of light which comes to his eye depends naturally on the amount reflected from the colored object, or which, for example, radiates from a railroad lantern. It is very evident that this quantity may vary from many causes, such as the nature of the illuminating material and the wick, the coloring matter of the glass, its thickness, the peculiar property of the glass, etc. If a little moisture or smoke, vapor, ice, snow, etc., adheres to the glass, the lantern is less luminous. A lantern illuminates differently in clear than in foggy weather. All this may give rise to mistakes. But, on the other hand, the sensibility of the eye differs greatly under different circumstances. The nervous apparatus of the eye may, like all other parts of the system, vary in its sensitiveness. The same light is brighter to a healthy eye in repose than to an eye fatigued and weakened. Every modification of the intensity of the light is, however, for the color-blind, a *change in color*. From this we may judge how little dependence can be placed upon a recognition of the signals which the color-blind gain from exercise.

"Hence, if we admit among a large number of color-blind an extraordinary faculty gained by the exercise of the eye with different degrees of intensity of light, we must equally deny that this is sufficient for the security of the roads, as we cannot be assured of all the lantern flames being of the same strength, all the glass of the same kind, of the same thickness, purity of color, allowing the radiation of the same quantity of light, and, finally, of the eyes of the employes being always at rest to the same degree, this being practically impossible. No person in his senses would deliberately trust his life in the hands of an engineer who could only distinguish the signals by the difference in the intensity of the light. Ask any superior official of a road if he would be willing to take charge of and run a locomotive, assuming the responsibility, when uncolored signals alone were permitted, and a feeble light meant 'danger,' a medium one 'attention or caution,' and a strong one 'road clear.' If he says no, tell him that these are just the conditions under which every color-blind engineer has performed his duties. The absurdity is evident at once.

"The aid an engineer can expect from those within his reach is as little to be depended on as the intensity of the light, especially as he himself is directed to observe the signals, and is responsible for what happens. Without noticing all the possible cases when he may at the moment of danger find himself without help, it will suffice to mention but a single one, namely, when his neighbors are also color-blind like himself.

"To sum up, we may grant that a number of circumstances concur in rendering railroad accidents from color-blindness of the personnel relatively rare, even when no measures have been taken to avoid them, and experience has fortunately confirmed this opinion; but, on the other hand, it is self-evident that such accidents may happen sometimes. Here also experience testifies, and there are probably many more accidents due to this cause than those proved to have so occurred. Under these circumstances, it is the absolute duty of railroad managements and maritime authorities to look to it that no measure which can aid in avoiding the possibility of these accidents shall be neglected, and to do all in their power to guard the lines of communication in the land and on the sea against all the dangers which menace them."

Dr. Stilling says, as a word of warning to those who are testing for color-blindness: "It is a well-known fact that color-blind persons, by exercising their faculty of judgment, can aid their want of sensibility, and are able to conceal their defect to a certain extent. They have learned the names of colors quite as well as normal-sighted people; and by the help of every outward sign, they have acquired a certain knowledge of those pigments to the characteristic tints of which they are blind. Very often that knowledge is developed in a surprising degree. Therefore, in testing one who is color-blind, we must take away the possibility of employing any of those outward characteristics which he is wont to make use of according to long experience. This is so much the more important, as most persons of this description have not the least suspicion of their imperfect power of sight; only very intelligent people understand their defect."

Very few of us who have good color-perception are aware how wholly the name of a color becomes the name of an attribute of any special object, and hence, how this name may be misplaced. In testing the uneducated for color-blindness, this becomes very apparent. The names of colors are often so misused as to suggest color-blindness where it does not exist. It seems hardly possible that, notwithstanding a good color-perception, the names of color are so much a matter of learning and memory. As Professor Holmgren says: "This especially applies to the color-blind, who seek in every way, and without themselves being aware of it, to supplement the chromatic sense nature has refused them. As color is an immutable quality of a number of objects, some of which are of one, some of another color, it is not very difficult to learn by heart the names of their colors. The immediate impression is not necessary for this. We may hear a blind person—even one born so—give the exact names of the colors of ordinary and well-known objects of which he has heard. For a color-blind person this is easier, because he obtains some help from his incomplete chromatic sense."

[On this point Dr. Jeffries cites some curious tests which he made with inmates of the Perkins Institute for the Blind—all but one perfectly blind. They were asked the colors of twelve objects named to them—"sky," "grass," "water," "apple," "cherry," "strawberry," "banana," "autumn leaves," "spring leaves," "orange," "this house," "bricks"—and in the great majority of cases the answers were correct.]

MEASURES NOW TAKEN TO AVOID DANGER FROM COLOR-BLINDNESS.

Are there not any such? will here at once be asked of me. I would much like to have been able to report on the some two hundred railroads of the United States in respect to any examination of their employes as to color-blindness. It is, however, a delicate question. From what I have learned, I conclude that here and there railroad superintendents keep it in mind; and when, from accident or otherwise, suspicion is aroused in reference to an employe, the latter is tested by the superintendent with the flags or lanterns used on the road. This suffices. No medical man, and much less an expert, is called upon. I shall be only too happy to be corrected, if I am wrong in stating that the railroads of this country are not more protected from the danger of color-blindness than were the roads of Europe before the very recent successful systematic efforts on the part of those from whom I have quoted in this article.

DIFFICULTY OF EXAMINATIONS IN THE UNITED STATES.

The government can, and no doubt soon will, carry out proper examinations for color-blindness in the army and navy. General national laws can also be enacted as to the merchant-marine. They will come in time as a matter of necessity. The difficulties with the railroads are, however, very great. Here the interests and safety of the community have to contend with ignorance, prejudice, pecuniary considerations and incredulity born of supposed immunity from danger. These corporations have no surgeons attached to their roads, who in their interests could carry out proper examinations to both protect themselves and the community. Even when interest is awakened from acknowledged danger justly feared, railroad managers are very likely to turn to any one calling himself a medical man, and rely on his statement as to his ability to examine and pass judgment on their employes. Then, when they are satisfied from his reports that they are safe, and accident happens, color-blindness is proved in the employe before the court and jury, and at once undeserved discredit is thrown upon the surety and usefulness of such examinations. It is therefore without hesitation that we would caution as to the choice of those to be engaged in testing railroad employes for color-blindness. The life-insurance companies of the country recognize this most thoroughly; so much so, that examination for life-insurance is almost a speciality.

We can scarcely hope for such practical good results as were shown in Sweden, where, by the simple efforts of one scientific man, all the railroad employes of the country were in a few months tested, and laws to govern the future made and enforced. Yet exactly the same is possible in this country as there. Either the state governments, or the state railroad commissioners, can require thorough examination of all employes for color-blindness, or the railroad managers can do it themselves. It is with some natural curiosity that the solution of the problem will be watched. In one of these ways this safeguard to travelers must come, since they will learn the danger they incur, as quickly as the railroad corporations the danger they subject them to, not to speak of possible damages recoverable after an accident due to color-blindness. Not only must railroad employes and mariners have good eyesight, but they must be proved to have normal color-perception.

CONCLUSIONS.

Certainly one in fifty, much more probably one in twenty, of the community, is color-blind in greater or less degree.

Of this defect they may even themselves be wholly unconscious.

This color-blindness may practically be regarded as red-

green blindness or blue-yellow blindness. Total color-blindness also exists.

This defect is congenital. It exists in varying degrees. It is largely hereditary. It may also be temporarily or permanently caused by disease or injury.

It is incurable when congenital. Exercising the eyes with colors, and the ears with their names, helps the color-blind to supplement their eyes, but does not change or increase their color-perception.

Experiment and experience show that we are forced to use red and green marine lights to designate a vessel's direction of motion and movements, and at least red lights on railways to designate danger.

Form instead of color cannot be used for these purposes. There are many peculiar conditions under which railroad employes and mariners perform their duty, which render colored signals, and especially colored lights, difficult to be correctly seen.

These signals can never be correctly seen by the color-blind.

There is, therefore, great danger from color-blindness.

Railway and marine accidents have occurred from it.

There is no protection but the elimination, from the personnel of railways and vessels, of all persons whose position requires perfect color-perception, and who fail to possess this. This can now be readily and speedily done.

Therefore, through a law of the Legislature, orders from state railroad commissioners, or by the rules and regulations of the railroad corporations themselves, each and every employe should be carefully tested for color-blindness, by an expert competent to detect it. All deficient should be removed from their posts of danger. Every person offering himself as an employe should be tested for color-blindness, and refused if he has it. Every employe who has had any severe illness, or who has been injured, should be tested again for color-blindness before he is allowed to resume his duties.

The same examination should be carried out among pilots and masters of steamers and sailing-vessels. These latter should also be especially instructed how to detect color-blindness among the personnel of their commands.

Effect of the Bessemer Steel Invention on British Iron Industries.

The London Times in an article reviewing the course of British industry in 1878 and previously, makes the following remarkable statements concerning the effect on the aggregate iron industry of the substitution of Bessemer steel for iron:

The relations of the coal and iron trades to each other, as well as to other interests, have recently undergone a change which has been so gradual and unobtrusive that less is known of it and heard about it than its importance demands. That this is the age of steel is a sufficiently familiar fact. Steel is not only employed nowadays for tools, cutlery, etc., but for railway bars, locomotives, ship-building, bridge-building, boiler-making and almost every purpose to which iron was formerly applied. The Bessemer process has ruined the manufacture of iron. It is due to that process that the production of iron rails fell in the North of England from 324,000 tons in 1873 to only 36,000 tons in 1877, and to a still smaller product in 1878; while in Wales the manufacture of iron rails has within the last eight years declined from 500,000 tons to about 50,000 tons. While the manufacture of iron rails has thus declined, that of steel rails has increased. In the Cleveland district alone one new steel works that was put in operation in the latter part of 1877 produced in 1878 upward of 60,000 tons of steel rails, or more than the aggregate production of iron rails throughout the whole of the North of England in the same time.

This transition from iron to steel involves issues that are not yet adequately understood. Steel rails are produced with one-fourth the fuel and one-third the labor required in the production of iron. At some works, indeed, where the pig metal is run direct from the blast furnaces into the Bessemer converters—as at the Cleveland, Barrow and Dowlais Works in England, and at the St. Chamond and Seraing Works abroad—there is practically no fuel used at all. When we add that from three to four tons of coal are required to produce a ton of iron rails, it will at once be observed that the transition from iron to steel has been concurrent with an enormous economy of fuel, and, consequently, accompanied by a very considerable decline in the quantity of coal used for metallurgical purposes. The exact volume of this decline is not easily determined, because we have not access to statistics of the quantities of malleable iron produced in the United Kingdom from year to year. If, however, we calculate, as did the Commissioners appointed to inquire into the coal famine, that 20,170,000 tons of coal were used in the conversion of pig into rolled iron in 1873, we shall be safe in assuming that since that year the quantity has declined by nearly one-half, and is now on the eve of a much greater decline. Within the next two or three years iron rails, by universal consent, will be known only as things of the past. It is very probable that iron plates for boiler and ship-building purposes will share the same fate. In that event the quantity of coal used for the manufacture of rolled iron will be a mere fraction of what it has been, and this is a contingency which coal-owners—particularly in the North of England, where nearly one-half the whole of the coal hitherto raised has been applied to metallurgical uses—can hardly contemplate without serious apprehension.

The substitution of iron for steel involves, as further corollary, a large decline in the amount of labor required to produce the same result; and it is undoubtedly to this contracting of the area of employment that much of the distress now prevailing is to be attributed. The North of England and Wales have unitedly given employment in past years to upward of 45,000 puddlers and mill-men. At the present time less than one-half that number is so engaged, and as steel makes further inroads upon the number will, of course, be proportionately less. There must therefore be a very serious deprivation of employment in the iron trade, and it happens, unfortunately, that the labor required in the steel trade is so limited in extent, as compared with the iron trade, that even if the volume produced remained the same, many thousands of workmen would still remain unprovided with work in either industry, and would be compelled, consequently, to transfer themselves to other occupations.

The past twelve months have done more than any previous year to accentuate the changes to which we have referred. The aggregate output of Bessemer steel in the United Kingdom during 1878 has not been short of 850,000 tons, while of open-hearth or Siemens steel the production of has been at least 150,000 tons more, making a total output, in round figures, of about 1,000,000 tons of steel; whereas in 1870 the production of both was under 230,000 tons. During 1878 new steel works have been put into operation at Rhymney and other places, and considerable additions are now being made to existing works in different parts of the country. As Bessemer-steel works increase and multiply, so must finished-iron works diminish in value and number; and it is of considerable moment that this should be better

understood than it is at the present time. The finished-iron trade of this country came to the front with extraordinarily large and rapid strides. In 1860 there were only 208 works for the manufacture of finished iron in the United Kingdom. In 1864 this number was increased to 248; in 1872, to 276; in 1874, to 298, and in 1877 to 312. The number of puddling furnaces employed in these works increased from 3,462 in 1860 to 6,338 in 1864, and 7,311 in 1872; but in the years 1874 and 1877 the number showed a slight decrease, owing to the growing depression of trade. Of rolling mills at work in the United Kingdom, the number increased from 439 in 1861 to 866 in 1871 and 942 in 1878. This development was, of course, induced by the demand for rails and plates made upon us by other countries up to the close of the year 1873, when our former customers began more generally, not only to supply themselves, but to become our rivals in neutral markets. Within 15 years the resources of production in the manufactured-iron trade of the United Kingdom increased to the extent of 2,467,000 tons, an increase far in excess of any probable demands. Of the 104 new finished-iron works erected between 1860 and 1877 many have now been closed for three or four years, and others are falling under this category almost every day. In the north of England fully a million and a half sterling invested in finished-iron works has been yielding no return for upward of three years; and in Wales probably a larger capital has been altogether unproductive. In both districts many works are valuable only for the old bricks and scrap-iron to be obtained by their demolition.

Contributions.

Slide Valve and Link Motion.

ST. LOUIS, Jan. 20, 1879.

TO THE EDITOR OF THE RAILROAD GAZETTE:

On page 33 of your issue of Jan. 17, Mr. Charles L. Palmer raises a question concerning a statement in my article on the "Slide Valve and Link Motion," on page 3, number for Jan. 3, 1879, which I am under obligations to him for bringing forward. If Mr. Palmer will kindly refer to fig. 10 of that article, I will try to defend myself from the imputed carelessness.

As I understand the term, the slip causing wear in the link block is caused by the vertical motions of the link and the pin *c* in the end of the rocker arm. The amount of vertical motion of *c* is governed by the length and swing of the rocker arm, or by its deviation from the vertical.

The vertical motion of the link at any point of its arc is made up of two motions, one caused by the swing of the link itself upon the pin *h* as a centre, and the other by the swing of the hanger about *g* as a centre. If the point *h* be taken off, the link arc, the vertical motion of the link about *h* as a centre, is increased. The distance of the pins *f* and *e* back of the link arc can only affect the slip by changing the swing about *h*.

If in the gear that is most used the point *h* be taken so that it covers the end of the rocker arm-pin *c*, while pin *g* covers rocker-arm centre (which appears to be in the drawing also designated by *h*), the whole hanger-bar will cover the rocker-arm for all positions of the eccentrics, and the vertical motion of rock-shaft and hanger would neutralize each other, the link rising and falling with the rocker, while the swing of the link itself would then be only so much angular motion, turning the slider but not causing it to slip. With long runs in one gear this will give good results; but my statement that the point of connection between the link and hanger should be midway between the ends of the eccentric rods is, of course, incorrect for this case. I had, in making my statement, assumed that the gear most used would be very close to the centre, in which I may be in error, though the connection midway between the eccentric rods will give least or very nearly least rise and fall of the link from the swing of the hanger.

If the other forward gears be examined, when the upper part of the link is nearing the shaft rocker arm is going up, hanger going up also, link swinging down; by moving pin *h* back of the arc the link may be made to rise and diminish the slip. But now if we look when the upper end is almost forward and moving in that direction, we find then that rocker and hanger are going up, link swinging down, and by the pin *h* being back of the arc it is caused to move downward still more. The movement of the hanger is not, however, equally from the vertical in this position. The pins *e* and *f* being off the link arc, cause the link to have more swing backward than forward (from the position shown in the drawing), and as Mr. Palmer correctly states, less slip then occurs by taking the pin *h* back of the arc.

The irregularity introduced by this element in the motion of the valve is greatest when the valve is nearest the ends of its motion, and produces much less effect when the valve is near enough to its middle position to open and close the ports. I shall be happy to send Mr. Palmer tracing from a drawing made of valve gear of Wabash engine No. 180 which was turned over for me by Mr. Johann, and given in the Railroad Gazette for May 24, 1878, from which drawing I found that, given laps and leads for the different gears, the points of cut-off were found by construction on page 3 of current volume to within $\frac{1}{8}$ inch, which result seemed to me sufficiently accurate to justify the method to engines as ordinarily constructed. The benefit of the method has seemed to me to be in "blocking out" new gear, and in comprehending the general action of them, rather than in refining old gears.

CHAS. A. SMITH.

Solidifying Petroleum.

The Engineer says: "It may be useful to note that the lightest petroleum may be partially solidified by mixing them with an aqueous decoction of soapwort. A mucilage forms which is so thick that the containing vessel can be overturned without any portion running out. In this form it might not be useful for some lubricating purposes. If a few drops of phenic acid are stirred into the mucilage, it soon becomes liquid again."



Published Every Friday.

CONDUCTED BY

S. WRIGHT DUNNING AND M. N. FORNEY.

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EDITORIAL ANNOUNCEMENTS.

Passes.—All persons connected with this paper are forbidden to ask for passes under any circumstances, and we will be thankful to have any act of the kind reported to this office.

Addresses.—Business letters should be addressed and drafts made payable to THE RAILROAD GAZETTE. Communications for the attention of the Editors should be addressed EDITOR RAILROAD GAZETTE.

Advertisements.—We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay, EXCEPT IN THE ADVERTISING COLUMNS. We give in our editorial columns OUR OWN opinions, and those only, and in our news columns present only such matter as we consider interesting and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes, etc., to our readers can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially, either for money or in consideration of advertising patronage.

Contributions.—Subscribers and others will materially assist us in making our news accurate and complete if they will send us early information of events which take place under their observation, such as changes in railroad officers, organizations and changes of companies, the letting, progress and completion of contracts for new works or important improvements of old ones, experiments in the construction of roads and machinery and in their management, particulars as to the business of railroads, and suggestions as to its improvement. Discussions of subjects pertaining to ALL DEPARTMENTS of railroad business by men practically acquainted with them are especially desired. Officers will oblige us by forwarding early copies of notices of meetings, elections, appointments, and especially annual reports, some notice of all of which will be published.

THE FREIGHT LOCOMOTIVE OF THE FUTURE.

To speculate about future events without knowing what the future has in store for us is usually very unprofitable, but the shadow of present events sometimes assumes the form of a kind of prescience which in a measure becomes prophetic. Therefore it may not be entirely futile to consider what kind of locomotive the growing conditions and requirements of railroad traffic seem to demand.

That it costs less to transport freight in large trains than in small ones, provided there is a great quantity to be transported, may be regarded as an established fact. The same thing is true of canal-boats and ships. Precisely what the maximum limit of economical size of train is will not be discussed now; it is sufficient to say that the limit has not yet been reached in ordinary practice. The recent general increase in the loads carried on freight cars has enlarged the economical, size of train, and at the same time demands more powerful engines. The probabilities seem to be that the carrying capacity of cars will be increased still more, from which will follow a need for still greater locomotive capacity.

The primary means by which a locomotive exerts its power is the adhesion of the driving-wheels to the rails, which, being determined by the weight they carry, the question of the capacity of a locomotive at once resolves itself into the one of the adhesive weight. This is limited in two ways, first by the weight which may be placed on each wheel, and second by the number of wheels that can be used. Up to the present time the first, it may be assumed, is limited to a maximum of about 12,000 lbs. per wheel. Therefore, with four wheels the greatest practical adhesive weight is 48,000 lbs., with six, 72,000 lbs., and with eight, 96,000 lbs. As the tractive power of a locomotive can only be about one-fourth of the adhesive weight, if the former is to exceed 12,000 lbs. the

locomotive must have more than four wheels; if it is to exceed 18,000 lbs. there must be more than six, or else the limit of weight per wheel named must be exceeded. The resistance of cars on, say, a grade of 50 feet per mile, is about $28\frac{1}{2}$ lbs. per ton (of 2,000 lbs.), and the curve resistance of, say, a 10° curve, is 5 lbs. more. If the weight of a loaded car is assumed to be 20 tons, the engine with four driving-wheels will haul about 16 cars up grades of 50 ft. per mile with simultaneous curves of 10° ; with six driving-wheels an engine would take 24 cars, and with eight 32 cars. This of course assumes that the cylinders and boiler are proportioned to the size of and weight carried by the driving-wheels. These figures indicate, first, the capacity of ordinary American engines with four driving-wheels, and of ten-wheeled or Mogul engines with six, and of Consolidation engines with eight. With the latter, though, some inconveniences must be encountered. In order to get a grate big enough, the fire-box must be made long and comparatively narrow, and to distribute the weight properly the trailing axle must be put under the fire-box, which in that position always gives more or less trouble from heating. In order to shorten the engine, too, and prevent too much overhang behind, the foot-board for the locomotive runner is placed on the side of the fire-box, and the fireman must stand on the tender. At least this is the arrangement on most of the engines of this class, and is adopted and the attending inconveniences endured because no way out of the difficulty is apparent if engines of that kind are to be used. It seems probable, though, that the requirements of traffic will demand even still more powerful locomotives, and that the problem will soon present itself of building engines which will take, say 50 cars instead of 32 over the grade and curves described. At present it is doubtful whether any locomotive-builder in this country would take an order for such an engine. Let us see what would be needed to do this amount of work. The resistance on the grade has been given at $28\frac{1}{2} + 5 = 33\frac{1}{2}$ lbs. per ton. Fifty cars, with the engine, would weigh about 1,075 tons, so that the total resistance would be, in round numbers, 36,000 lbs., which would require an adhesive weight of at least four times that amount, or 144,000 lbs., on the driving-wheels. If the load on each of the latter must not exceed 12,000 lbs., the engine, to take a train of that weight, must have twelve such wheels. How then could such an engine be built so as to pass around the curves without difficulty, and not have the weight per wheel exceed the limit of 12,000 lbs.? The present solution of the problem is, that in localities where such an amount of power is required, as in ascending the grade on the Pennsylvania Railroad west of Altoona, two ten-wheeled engines are coupled together, thus doubling the power. This, of course, involves the expense of two sets of men to run the engines, and two entire machines must be maintained. The weight of each engine and tender is about 65 tons, or a total of 130 tons of engine required to take the trains up the mountain. The driving-wheels are 54 in. in diameter, and spread 12 ft. 6 in. from the centre of the leading to the centre of the trailing wheels. Suppose now that instead of six wheels of that size we put the engine on twelve wheels of only half that diameter, or 27 in., and place them 30 in. apart. The total rigid wheel-base would then be the same as before. We will also suppose that cylinders of the same size are used with the small wheels as with the big ones, but that the engine is so arranged that the load on the twelve small wheels is twice what it was on the six big ones. It is evident that with the smaller wheels the cylinder could exert twice the tractive force, and, if the weight on them is also increased in the same proportion, that the engine would pull twice as much load with the twelve little wheels as it did with the six big ones. If, too, the pistons make the same number of strokes per minute, the same quantity of steam will be consumed, so that the same boiler would answer in both cases, the difference being that while with the little wheels twice as much load could be pulled, the speed would only be one-half what it was with the 54-inch wheels. Practically the method of increasing the capacity of locomotives is that which has been described; that is, the size of the wheels is diminished, and they are arranged so as to carry a larger proportion of the weight. Thus American engines usually carry two-thirds of the weight on the driving-wheels, which are about 60 inches in diameter, and they have 44 square feet of heating surface per ton of adhesive weight. A ten-wheeled engine has wheels about 54 inches in diameter, which carry three-fourths of the weight, and it has 38 square feet of heating surface per ton of adhesive weight, while Consolidation engines have 50-inch driving-wheels which carry over seven-

eighths of the weight, with nearly 35 square feet of heating surface per ton. If we were to construct an engine with twelve 27-inch wheels, as described above, the amount of heating surface per ton of weight on these wheels would be only 19 square feet, and it was shown that that amount would be adequate for the work the engine would do. It will thus be seen that the amount of heating surface per unit of weight on the wheels is very nearly in proportion to their diameter.

While engines with very small wheels, similar to those described, have been built for traffic on steep grades, yet there are some serious objections to their use for general traffic, while it is true that with such an arrangement the weight per wheel is no greater if we put 144,000 lbs. on twelve 27-in. wheels than it would be if we put 72,000 lbs. on six 54-inch wheels, and that the rails would then in great measure be secure from undue wear; yet, in order to curve easily, the wheel-base must not be greater in the one case than the other. The result would follow that the weight per lineal foot of track, with the one engine, would be twice what it would be with the other; which means that the cross-ties, ballast and substructure of the track must bear twice the load. It has been shown, too, that while the engine with twelve small wheels would pull twice the load, the speed would be only half what it would be with one having six wheels of twice the size. While this is no very serious objection to the working of traffic on a short section of a road where there is a heavy grade, yet it would be a great hindrance if the whole business of a line had to be done at a reduced speed. While it may be true that the injury to the track and the rolling-stock is greater at a high rate of speed than at a low one, yet it has come to be recognized that the difference of wear and tear at speeds less than 25 to 35 miles per hour is very difficult to estimate. It has also been shown that the consumption of fuel is very little if any greater at such speeds than it is at a lower limit. At the same time, there are other train expenses, especially wages of men, which are in almost exact inverse proportion to the speed. Besides this, on a crowded line, a very much greater amount of traffic can be done if the trains run fast than is possible if they run slow. The amount of service performed by engines and cars is also increased with the speed, so that it seems probable that the demand in future will be for higher rather than slower speed, and therefore it will be inadmissible to increase the capacity of the engine to pull greater loads if at the same time its speed is reduced. It should be kept in mind, too, that on most roads it is only at comparatively a few points that an engine must exert its maximum power. Thus on a straight line with a grade of 25 feet per mile the resistance would be half what it is on the 50-foot grade with a 10° curve. On a 10° curve and a grade of 10 feet per mile the resistance would also be about half what it is on the 50-foot grade. What seems to be needed is an engine capable of running at the required speed for ordinary traffic, but with some auxiliary power which could be used at the ruling grades or the different points on the road, so as to increase its maximum capacity. In doing this, though, some difficulties are encountered. Thus, suppose we have an engine with six driving-wheels 54 in. in diameter, weighing 72,000 lbs. without a supply of water and fuel. With 2,400 gallons of the one, and two tons of the latter, we would have an additional weight of 24,000 lbs., or a total load of 96,000 lbs. If, now, we want to double the capacity of the engine we would require twice as much boiler, water-supply, etc., or, in other words, would have twice the weight, or 192,000 lbs., not taking into account the tanks needed to carry water and fuel. This, if we used twelve wheels, would impose a load of 16,000 lbs. per wheel, making it evident that such an engine must carry a part of its water and fuel on a tender.

It has been shown, though, how easily the power of an engine may be increased by diminishing the size of the wheels and the speed at the same time. As the auxiliary power is only intended to be used at times when the engine may run slow, there is no insuperable objection to using such wheels for that purpose. Suppose, then, that we were to build an engine with six driving-wheels 54 in. in diameter placed between the smoke-box and fire-box in the ordinary way, and we then extend the frame out beyond the fire-box far enough to carry a water tank and the foot-board, and place a truck underneath this extension of the frames with six 27-in. wheels and provide it with a pair of cylinders attached to the truck frame, after the manner adopted by Mr. Fairlie and Mr. Mason, so as to convert these small wheels into driving-wheels. The latter, being only half the size of the other driving-wheels, would require only half as much heating sur-

face per ton of adhesive weight, and they and their cylinders, connections, etc., it may be roughly assumed, will weigh only half as much as the corresponding parts of the larger wheels. As our auxiliary engine will be required to work for only comparatively short distances, it may be safe to estimate that only half the quantity of water and fuel will be required. The weight of our machine would then be as follows:

	Lbs.
Large driving-wheels, cylinders, boilers, etc.	72,000
Small	36,000
Supply of water and fuel	36,000
Total	144,000

This, divided by twelve, would give a weight of just 12,000 lbs. per wheel, which places such a scheme within the range of possibility. The practical difficulties in the way of the construction of such an engine are great, but Mr. Mason has shown that there is no great trouble in using cylinders on a truck frame. If such a plan is feasible, it would produce a locomotive with about 50 per cent. more tractive power than a Consolidation engine. The arrangement proposed for the wheels would not make it necessary to place any of the axles underneath the fire-box, and as they are all in front of the latter, it can be widened out to much greater width than is practicable when it must be placed between the wheels. This makes a much larger grate possible, with a corresponding steam-producing capacity, which, it is believed, would be adequate for supplying both pairs of cylinders.

Such a machine would have twelve wheels, whereas a Consolidation engine and tender have eighteen. This difference, it is believed, would compensate, in a measure, for the addition of another pair of cylinders with their connections and parts; but even if it did not, the great increase in the capacity of the engine would more than warrant the duplication of these parts.

It is true that the practical difficulties in the way of carrying out such a plan are very great, but theoretical considerations indicate its possibility, which is all that this article is intended to set forth.

The Pacific Railroad Decision.

The decision of the United States Supreme Court in the case of the company against the government, for the payment of one-half of the earnings from government transportation withheld, finally settles a question which has been in controversy ever since the roads were opened, and which affects to a considerable extent the value of the shares of the Pacific companies. It would affect them still more but for the Thurman bill passed last year, which puts the matter on a new basis from the first of July, 1878—or will, if it is held constitutional by the Court, as the companies contest its validity.

The law under which the Pacific railroads were organized and granted their subsidies in government bonds required that they should pay to the government one half of the earnings from the transportation which they might do for the government, and 5 per cent. on the net earnings from the date of the completion of the road, toward paying the interest on the bonds and the principal when it becomes due.

Hereupon two questions arose. The Union and Central Pacific companies claimed that the road was completed, not when it was opened through for business, in 1869, but five years afterward, when the government finally accepted the road as completed, and made over to the companies the remainder of the lands to which they were entitled. This would make a difference of about \$1,100,000 in the amount now due to the government from the Union Pacific, that being, approximately, 5 per cent. on the net earnings from the time the road was opened until October, 1874, when the company claimed that the payments first became chargeable. The Court decides that the 5 per cent. of net earnings must be paid from the opening of the road.

The other chief question was the interpretation of the term net earnings as used in the act. The government claimed that it meant there what it commonly means in railroad reports, that is, the earnings of the company's business less the cost of conducting it—gross earnings less working expenses. The company, on the other hand, claimed that the interest paid by the company on its bonds should be deducted, as well as working expenses, in order to arrive at the net earnings from which it was to pay 5 per cent. per year to the government. The interest on the company's first-mortgage bonds (which is the only mortgage on its road on which it pays interest), amounts to \$1,633,890 a year, so that the difference due to this in the amount of the "5 per cent. of net earnings," would be \$81,694.50 per year. With respect to its land-grant bonds, we believe that the company did not claim that the interest on them should be deducted, they not being a lien on the road.

The decision of the Supreme Court is substantially in favor of the government's interpretation. Net

earnings are held to be the gross earnings of the road, including the earnings from government transportation (half of which are withheld), but not the receipts from its lands, less "the necessary expenses of operation and all expenditures for ordinary improvement and repairs, but not expenditures arising out of the company's land department nor interest upon its bonded indebtedness. The latter, the Court holds, is not properly chargeable against receipts in computing net earnings." But the Court also holds that though the interest on bonds must not be deducted from receipts in order to ascertain the net earnings, from which 5 per cent. is due the government, still the interest on the first-mortgage bonds is a claim prior to the government's, and if the net earnings are not sufficient in any year to pay both, then the five per cent. need not be paid the government that year. This, however, is not a practical question with the two great companies, the Union Pacific and the Central Pacific, as their net earnings, calculated as the Court directs, after paying first-mortgage interest have always been several times as great as the 5 per cent. of net earnings.

The application of this decision to the Union Pacific Railroad is made approximately below. The reports are for the calendar years, and we have no figures for the fraction of the year 1869 during which the road was worked, nor for the first half of 1878, at the close of which the Thurman bill terminates the operation of the provisions of the bill interpreted by the Court. The company's reports include no earnings from the land grant (which are all applied to reducing the land-grant mortgage), neither do they include those of the Omaha Bridge, which we believe another decision makes it necessary to include. In 1876 the net earnings of this bridge were \$256,000; in 1877, \$196,000.

Below we give the net earnings, the 5 per cent. on them due the government, and the amount of net earnings after paying interest (\$1,633,890) on the first-mortgage bonds, for the eight calendar years ending with 1878:

Year.	Net earnings.	5 per cent. due government.	Net earnings, less 1st-mort. interest.
1870.	\$2,947,862	\$147,393	\$1,313,972
1871.	3,921,115	196,055	2,287,925
1872.	4,092,032	204,602	2,458,142
1873.	5,291,243	264,562	3,657,353
1874.	5,705,176	285,259	4,071,286
1875.	7,011,784	350,589	5,377,894
1876.	7,618,548	380,922	5,954,758
1877.	7,199,782	359,989	5,569,892

The sum of the 5 per cent. of net earnings for these eight years is \$2,189,381, to which must be added the amounts for the part of 1869 that the road was open, and for half of 1878, which will bring up the amount due on this account, probably, to about \$2,400,000. Against this the government held at the end of June last \$1,747,691, which it had withheld from the amount earned by the road on government business. (The law makes one-half of this applicable to current interest paid by the government, and the above amount was withheld from the other half in consequence of the non-payment of the 5 per cent. of net earnings.) Apparently, then, something like \$650,000 becomes due immediately to the government from the Union Pacific Railroad Company, in consequence of the Supreme Court's decision. The addition of the net earnings of the Omaha Bridge may make the sum somewhat (but not very much) larger.

Under this decision, the amount due from this company to the government, on account of its advances, was, in 1877, nearly one million of dollars, namely:

One-half of government transportation	\$627,117
5 per cent. of net earnings (including bridge)	309,790
Total	\$936,907

Under the Thurman bill, if it had applied to that time, the amount due for the year ending June 30, 1878, according to the report of Mr. French, the government Auditor of Railroad Accounts, the payments would have amounted to \$1,338,794. For the same fiscal year Mr. French estimated (before this decision, but on substantially the same basis as the decision makes) that under the old law, the law actually then in force, the amount due was \$968,397. From this company, then, the Thurman bill requires more than the old law, under the Supreme Court's decision, so that the company will still be interested in having the Thurman law declared unconstitutional.

We are not able to trace the effect of the decision on the Central Pacific, because that company reports with the earnings of the road from Ogden to San Francisco, which alone has a subsidy and owes anything to the government, those of a great number of other roads of greater aggregate mileage which it works in various parts of the state of California. We have no means of knowing what the net earnings of the main line by itself have been since the road was opened. But in the case of the Union Pacific nearly two-thirds of the yearly dues under the old law arise from earnings from government business. Now these earnings are very much greater on the Union Pacific than on

the Central Pacific. The one-half of them that had accumulated down to June 30, 1878, amounted to \$4,105,179 for the former and to but \$1,529,302 for the latter company. If the Central Pacific's main line net earnings were the same per mile as the Union Pacific's, the 5 per cent. on them in 1877 was about \$305,000, but the one-half of earnings from government transportation was less than \$174,000, and the total due the government under the law that year was but one-half the amount due from the Central Pacific. By the Thurman law, however, it would have been about \$1,090,000. Thus the operation of the law increases the payments of the Central Pacific 127 per cent. where it increases those of the Union Pacific but 37 per cent., and the former has more reason than the latter to prefer the Supreme Court's interpretation of the old law to the provisions of the Thurman bill. The 5 per cent. of net earnings due from the Central Pacific down to the end of June last probably amounts to but little less than that due from the Union Pacific—we should say that it cannot well be less than \$2,000,000. Against this the government had withheld down to June 30, 1878, from transportation dues, the sum of \$814,358.

The application of the law to the other subsidized Pacific railroads has little interest. None of them are in condition to pay anything to the government without withholding interest from some of its bondholders.

It is five years that this question as to the interpretation of the original Pacific Railroad act has been pending, making doubtful all that time the exact financial position of the companies. And when the decision comes, the law which it interprets has been superseded already for six months by a new one, the validity of which the companies contest, and which will also, doubtless, have to run the gauntlet of the courts. It is to be hoped that it will not be so long in reaching a final settlement.

Profits of an Elevated Railroad.

The Metropolitan Elevated Railway reports that from the time it was opened, June 5, till Dec. 31, which is just 30 weeks, during which trains were run six days in the week, the gross earnings were \$638,759.55, the expenses \$289,670.09, and the net earnings \$349,089.46, the working expenses being 45½ per cent. of the receipts. This is at the rate per working day of \$3,548.66 gross earnings and \$1,921.48 net, which for the whole year would give \$605,088 of net earnings—a pretty good return for a railroad five miles long, if it is a bridge all the way. The capital account for the part of the road completed is \$3,155,000 of stock, \$3,000,000 of first-mortgage bonds and \$4,500,000 of second-mortgage bonds. The first-mortgage bonds bear 6 per cent., the second (we believe) 7 per cent. interest, amounting together to \$495,000 per year. On the basis of the results of the first thirty weeks' work, therefore, the net earnings would appear to be \$110,000 per year more than the interest charges, which is about 3½ per cent. on the stock. But the profits of the first thirty weeks are not a safe criterion of the average profits, even of the part of the road now completed, which is in a district fully built up. Probably the traffic will average somewhat greater, even in the first year or two, before there has been time for much growth of the city on the line and above, but it is also probable that the expenses were then much below the average, as it was too early for road or rolling stock to begin to wear out, and the maintenance expenses must have been very light. What it will cost to maintain the road, aside from the rails, it is not easy to estimate. It will, or ought to be, a great many years before any important parts of the bridge structure will need renewal, but evidently there will be an enormous painting bill at not very distant intervals. The rails do not wear out very fast, in spite of the great train service—the largest in the world, amounting now to 441 trains over each track daily—because the trains are light, the engines only about one-third of the weight of a good passenger engine on a surface road, and the speed is moderate; but with net earnings of \$120,000 per mile per year, the renewal of the track every year would not be much felt: at present prices of steel it would cost about \$8,000 per mile—about two weeks' gross earnings. At the present rate of train service (which is greater than the average for the period reported, however), the earnings of the 30 weeks were 80.6 cents and the expenses 36.8 cents per train mile. The average of steam railroads is much greater than this. In Massachusetts in 1877 the average receipt was \$1.45 and the average expense 92 cents per passenger train mile; in New York the same year the receipts were \$1.18 and the expenses 80 cents. The Metropolitan train crew is probably nearly as expensive as the average; there are not quite so many of them, perhaps, but, owing to the moderate speed of the trains (averaging about 12 miles an hour) and the short runs, they do not make as great a mileage per day as the average train crew.

The company does not report the number of passengers carried. It has stated, from time to time, that "about" 50,000 per day was the number, and it has also stated that something less than half the passengers were carried at the 5-cent fare that is accepted four hours in the day. If just half were taken at this rate, then the average rate was 7½ cents, and the average number of passengers every day that the cars run was 47,316, and the average expense 3.4 cents per passenger. If a larger proportion was carried at the 10

cent fares, then the average daily number carried for pay was less, and vice versa. It is presumed that the number of dead-heads, great as it may be in a city like New York, under a government like New York's, and with the company's disposition to keep the favor of every one, as far as possible—it is to be presumed, we say, that the number of dead-heads has yet been but a trifle in comparison with the enormous paying traffic. The latter, at the rate above indicated, will be about 15,000,000 passengers per year. The London Metropolitan (underground), the last year reported, carried about 58,000,000 passengers; but its traffic is of a radically different character, a very large share of it being passengers on the trains of other railroads, which use the Metropolitan track for half a mile to three or four or more miles to reach their London stations.

Of course the five miles or more of road which the New York Metropolitan is now building on the west side of the city, through a district now very thinly-peopled, cannot for some time have anything like so heavy a traffic as the line now in operation. The mortgages being on the whole road, and not on separate sections of it, this must be taken into account in estimating the security of the bonds. On the other hand, the company is not compelled to issue \$1,500,000 per mile on it, as it has done below Fifty-ninth street, where its report indicates that the traffic will earn full interest on that amount. The cost of the structure is not one half of this amount. For the existing part of the road the rolling stock must have cost an amount counted by hundreds of thousands of dollars; but the extension on the west side of the city will not require anything like so much.

The indication that there will be a very large return on the actual investment in this road is the more gratifying because the accommodations provided the public are, with a single but important exception, such as the most fastidious cannot except to. The cars are probably the most beautiful ones (not the most costly, however), that ever were built. Not many private carriages are so truly elegant. They are usually well heated. The stations are as tasteful as the cars. The frequency of trains is greater than was supposed possible before this road was built (at certain times of the day 32 per hour each way), and they run late and early, leaving barely time enough after midnight for any work on the track that may be necessary. The only drawback, almost, is the crowded condition of the cars at certain times of the day, it being not uncommon for a car seating 48 to have more than a hundred passengers, this in its turn causing much crowding and some delay at certain of the stations. This, however, is an evil which seems difficult to remedy, as the engines can haul but three cars to the train, and the trains can hardly run safely at shorter intervals. If longer trains could be hauled, it would be a very great advantage, but the 90 ft. curves at the street corners are a great obstacle to this. It has been reported that the company is preparing to buy buildings at the corners to enable it to make these curves easier. If this will enable it to haul one more car per train, the costliest land in the city would be cheap for such a purpose.

Color-Blindness.

We call particular attention to the discussion in this number of the subject of color-blindness, taken from Dr. B. Joy Jeffries' contribution to the Massachusetts Board of Health Report for 1878. We have often heretofore called attention to the subject, and adduced statistics which indicate that the defect is not an uncommon one, and often goes undetected where we might suppose that it would very soon attract attention. But this paper shows very clearly not only that it is so but why it is so, and moreover that even examinations made for the very purpose of detecting the infirmity may not make it known either to the examiner or to the person examined. We are apt to forget that the color-blind are as conscious of form and light and shade as any of us, and indeed are usually more so, these senses being sharpened by the demand on them to make up for the absence of the color sense. The man who cannot tell red from green, for whom indeed red and green do not exist, in the red or green lamp sees a luminous object of a definite form and a definite degree of brightness—less bright than a white light, and brighter than some other colors. The red and green disks are to him gray discs; but there are degrees in grayness, and he may usually be able to distinguish one from another by this difference. If he could always, and if there were no two different colors which might have the same degree of lightness or darkness, making the same grade of gray to the color-blind, we would not need to trouble ourselves about color-blindness. But the most delicate sense of light and shade will not always enable the color-blind to distinguish between the gray of red and the gray of green, and moreover, the lightness of the signal may be very greatly affected by its position. What was dark in the shade becomes almost white in the sun; and a mist changes very greatly the relative lightness or darkness of two colors. Evidently it will not do to ask the candidate to tell what the color of any given object is. A great many mistakes may be made in that way, in both directions; for there are not a few who can distinguish colors but cannot name them correctly, as well as some who know the names of the colors belonging to objects with which they are familiar, though they were never really conscious of the color.

Record of New Railroad Construction.

This number of the *Railroad Gazette* contains information of the laying of track on new railroads as follows:

Chicago & Tomah.—Extended from Junction east by south to Fenimore, Wis., 15 miles. It is of 3 ft. gauge.

Denver, South Park & Pacific.—Extended from Slaght's, Col., southwest to Grant, 7 miles. It is of 3 ft. gauge.

Southern Pacific.—Extended from Adonde, Arizona, eastward to Mohawk Gap, 30 miles.

THE NUMBER OF RAILROAD OFFICERS deemed necessary to work a railroad in Germany does not accord with American ideas. The Grand Duchy of Baden has a little railroad system, the head-quarters of which is at Karlsruhe, and the extent of which are 740 miles, of which 240 are double-track roads. This system is worked with 386 locomotives, 1,006 passenger cars (with an average seating capacity of 40 each), 192 baggage cars and 5,746 freight cars. Now, what is called the "technical staff" of this system—about as big as the Chicago & Alton's—not including the commercial staff, consists of five engineer members of the "general direction," one of whom has the title of "Chief of the Technical Division of the General Direction," attached to whom are two "inspectors of structures" (Hochbau-inspector), three "inspectors of road construction," one "telegraph inspector," one "technical inspector of transportation," two "engineers of the first class," an "engineer of machinery," one "engineer," and one "car comptroller." The above are the staff officers, as it were, of the general commanding, who keep their eyes on the following general, field and line officers who work the road: *Road Construction.*—One chief engineer, two district engineers, one inspector of construction, five engineers of the first class. *Road Operation.*—Three chief engineers, three district engineers of road, four district engineers of machinery, one chief master of machinery and foreman of the main shops, one telegraph comptroller, nine road engineers, four engineers of machinery, and one comptroller. Here are 52 engineer officers for 740 miles of road. The Kingdom of Bavaria, which has 2,466 miles of road, and but 160 of double track, with 991 locomotives, 2,497 passenger cars and 14,785 freight cars, has no less than 209 technical officers of various grades, sixty of whom are in the rolling-stock department, all but a few of whom have the title of "master of machinery." The railroads worked by companies do not show any such lists. The Cologne & Minden, for instance, whose system is nearly as large as that of the Grand Duchy of Hesse (698 miles against 740), with a very much greater rolling stock, has 42 in its list, ten of whom are in the rolling-stock department—one chief master of machinery, one vice-chief master of machinery, seven masters of machinery, and one chief of the car department. The Prussian government roads are not so lavishly supplied with officers as those of some of the small states. It works the Berg & Märk road, which is one of the busiest in Germany—901 miles of road, 456 of second track, 810 locomotives, 648 passenger cars and 20,327 freight cars—with a staff of 55 officers. The German Empire itself takes care of the 788 miles of railroad of the new provinces of Alsace and Lorraine with a force of 68 officers. Doubtless in this country the custom is to put up with too small a force of officers—giving them so much to do that they have no time to think. In Germany, however, they seem sometimes to go to the other extreme.

LOUR RATES have been complained of in Minnesota as unduly high in comparison with wheat rates. General Manager Merrill, of the Chicago, Milwaukee & St. Paul road, has written a letter in which he shows, what ought not to have needed showing to any one in Minnesota, that there is no basis for this charge; that, indeed, the discrimination is the other way. The standard flour rates, indeed, seem to contradict flatly some of the most generally accepted rules of rate-making. A barrel of flour is rated as 196 lbs. of flour. But it usually contains more, and, with the barrel, weighs an average of 220 lbs. Now, it is the universal practice, we believe, to accept the barrel of flour at the same rate as 200 lbs. of wheat, wheat being usually (but, in the West, not always) carried at the lowest rate of any freight. But here we have a manufactured article carried for less than the raw material; the flour is more valuable, and ought to be able to pay more; it is more liable to damage, and, if destroyed, the loss to be made good is greater than in the case of wheat. It is not easy to see how it has ever been classed as low, unless it is that the millers, shipping in large quantities, are better able to negotiate for low rates than the average grain shippers, many of whom ship but small quantities. Moreover, it would apparently be for the interest of the railroads to have the equivalent wheat shipped instead of flour, as they would then get 300 lbs. of freight instead of 200. There is some advantage, however, in having mills on a road, and the result shows that the railroads have been forced to encourage them, whether for their interest or not. Considering the fact that, at current regular rates, a bushel of wheat will go through from Minneapolis to New York for 11 cents less in the form of flour than in its natural condition, it would seem not to be the fault of the railroads that there is not more of it manufactured in the states where it grows. One reason, doubtless, is that all the products of the wheat are marketable, and the bran and other "mill-stuffs" that do not go into the flour barrel are much more valuable in the East than where the wheat is grown and where oats and corn are plentiful and cheap. If all the products of the wheat had to be sent east to be consumed, the miller would, at the same rates per 100 lbs., have to pay precisely the same as the grain shipper, and the Western mill would have no advantage over the Eastern. But there is a considerable market for mill-stuffs in the West, and especially as far north as Milwaukee and Minneapolis, where not much corn is grown.

DECEMBER EARNINGS are reported in our table for 24 railroads with 15,877 miles of road, which is about 19 per cent. of the total in operation in the United States. These

in the aggregate earned 0.7 per cent. less in 1878 than in 1877, although they had 4.6 per cent. greater mileage, and the average earnings per mile of road fell from \$552 to \$524, or 5 per cent. December in 1878, moreover, was not a very favorable month. Rates were generally good, but traffic, though heavy on many roads was made light on many others by bad country roads. Our table last year showed an average decrease in earnings per mile of 4 per cent. from 1876 to 1877, while there had been one of 9 per cent. from 1875 to 1876. If this represented the average condition of things, it would be extremely unsatisfactory, but the roads reporting do not include any line, except the Philadelphia & Reading, east of Toledo, and the table cannot be taken as representing the average tendency of the railroads of the country.

Fourteen of the 24 roads reporting show increases in total earnings, and 12 in earnings per mile, but the decreases are the largest in amount, a very large part of the whole being on the Philadelphia & Reading.

For the year 1878 we have reports from 29 companies, with 19,081 miles of road. These, with a mileage 2.9 per cent. greater, earned in the aggregate 2.9 per cent. more money in 1878 than in 1877, the average earnings per mile being substantially the same in the two years, \$7,926 in 1878 and one dollar more in 1877. Twenty of the companies reporting show increases and but nine decreases. The totals in the table are greatly swelled by the presence of the earnings of the Pennsylvania Railroad and the Philadelphia & Reading, which do not usually report. The Grand Trunk and the Great Western also report, and as these three have a true trunk-line traffic, being largely supported (or at least busied) by the traffic between the West and the eastern seaboard, it will be interesting to compare their earnings by themselves, as follows:

	1878.	1877.		
Pennsylvania..	\$31,630,734	\$31,117,146	Increase	1.7 p. c.
Grand Trunk..	8,862,327	9,416,878	Decrease	5.9 p. c.
Great Western.	4,447,073	4,534,070	Decrease	1.9 p. c.

Three roads, \$44,946,134 \$45,068,700 Decrease 0.3 p. c.
Taking the three together, their earnings were thus substantially the same in 1878 as in 1877.

A RAILROAD STRIKE IN ENGLAND has attracted a great deal of attention in that country, though it was conducted much more quietly and orderly than have been most of the railroad strikes here. The occasion of the strike was a reduction of 5 per cent. in the wages of certain classes of employees on the Midland railway—one of the great companies, and noted for the numerous innovations into prevailing English railroad practice that it has introduced—running third-class cars on express trains, abolition of second class, introduction of Pullman cars and other passenger cars on trucks. The strike was begun by the "goods guards," who in the American railroad language are known as "freight conductors." Their chief grievance seems to have been not the reduction in wages, but the introduction of the system of paying by trip instead of strictly by the day. The trip system, however, was introduced last spring, and the only change was basing the week's wages on trips estimated to require 66 hours service instead of 60, as heretofore. The wages would be called very low here, being from \$5.84 to \$7.30 per week, with certain allowance for times when the men have to sleep away from home—this for 66 hours' service, or its equivalent in trips. The strike seems not to have blocked freight traffic anywhere, though there were delays, and we understand that it was virtually over about two weeks after it began, though most of the men seemed to be still holding out at the time of issue of the latest English newspapers that have arrived, and the telegrams that announced the virtual close of the strike did not say how it closed—whether by the return of the old men or the engagement of a sufficient force of new ones, or whether the company made any concessions. The men, in their meetings, demanded an unconditional return to the old basis of wages previous to last spring. They had no society's support in the strike, the Amalgamated Society of Railway Servants taking no part in it as a society. The organ of this Society laments that the men did not more generally belong to the Society, which then, it says, would have been in position to secure favorable treatment of the employees, or the success of a strike, if it came to that.

THE GERMAN POST-OFFICE PARCEL SERVICE, of which we have made mention heretofore, accepts packages weighing 110 lbs. and under; the regulations that we have seen do not limit the size or the material that may be sent, but there doubtless are some restrictions. The rates are for 11 lbs. or less for distances of 47 miles or less, 6 cents; more than 47 miles, 12 cents. For every additional 2.2 lbs. (kilogram) 1½ cents for 47 miles or less, 2½ cents for 47 to 94 miles; 5 cents for 94 to 235 miles; 7½ cents for 235 to 470 miles; 10 cents for 470 to 705 miles, and 12 cents for distances greater than 705 miles. This would enable one to send an overcoat or a shot gun from New York to Buffalo or Pittsburgh for 12 cents, provided it weighed but 11 lbs.; but if it weighed 12 lbs. it would cost 20 cents; if 20 lbs., 50 cents; while a package of 110 lbs., the greatest permissible weight, would be taxed \$3.40. This seems an irrational method, and it would be if it was based on the cost; but the Post-Office Department probably wishes to leave the railroads a little freight to carry for which they may get the pay themselves. They get nothing for carrying the mails.

GERMAN LOCOMOTIVE WORKS are twenty in number, with capacity for from 8 to 250 engines yearly, and an aggregate yearly maximum capacity of 1,922. One of these in the whole of its existence down to the close of 1878 had

turned out 3,750 locomotives (Borsig's, at Berlin), a second 2,600, a third and fourth 1,700 each, a fifth 1,250, four others from 900 to 980 each. Besides these strictly German works, there are five in Austria-Hungary, and three in Switzerland, though one of the Swiss works has made no locomotives since 1867. One of the Austrian works belongs to a railroad company; it has built 1,560 engines and can turn out from 80 to 100 yearly.

NEW PUBLICATIONS.

An American Geological Railway Guide.—This volume, prepared by James Macfarlane, author of "The Coal Regions of North America," and published by D. Appleton & Co., is something novel in the literature of geology. It assumes to give the geological formation at every railroad station in the United States and the Dominion of Canada, so that the student or traveler may study geology at railroad speed, as it were, being able to ascertain as he passes the formation that may be on the surface. Of course its usefulness is not limited to travelers, but wherever one may be he can ascertain the formation by reference to this book—unless he should be very far from any railroad. Thus it makes, as it were, a geological map composed of printed pages.

The arrangement is the simplest possible, and as easy to refer to as an ordinary railroad guide. Each state is by itself, and has a list of the stations and distances on each railroad in it, the name of the formation being given opposite the name of the station. Thus, we have for railroads which penetrate into the heart of the Catskill Mountains from the Hudson River, the following:

Ulster & Delaware Railroad.		
Miles.		
0.....	Rondout 11a.....	4c. Hudson River.
4.....	Kingston.....	6. Water lime.
9.....	West Hurley.....	7. Lower Helderberg.
12.....	Olive Branch.....	10. Hamilton.
15.....	Brook's Crossing.....	11. b. Chemung.
17.....	Broadhead Bridge.....	11. a. Portage.
18.....	Shokan.....	11. Chemung and 12. Catskill.
21.....	Boiceville.....	12. Catskill.

—and so on.

The note referred to by the figures attached to "Rondout" is:

"The Rosendale cement, manufactured near Rondout, is from the 6. Water-lime rock, which is here between the Medina sandstone and the Lower Helderberg limestone, the intermediate forming being wanting. It is a light blue, fine grained limestone, with smooth, conchoidal fracture. The same formation furnishes the hydraulic cement made at Syracuse, N. Y., and elsewhere."

If, now, the names and figures denoting the formations are without significance to the ungeological reader, he has only to turn to the beginning of the New York list, where is a table of the formations in the state, named and numbered from the primary rocks up. Here he will find "4c. Hudson River" to be a group of shales at the top of the Upper Cambrian, just above the Trenton limestone, and just below the Medina sandstone, which is at the bottom of the Silurian; the "6. Water lime" the third from the top of Silurian, just above the Onondaga salt group; and so on. But this is not all. There are prefixed to the "guide" proper tables of the formations and a description of them, very clearly written, and not so long but that the traveler can read one while the formation is before him—unless the transitions are unusually frequent where he is riding. Thus with this book we may take an unending series of "object lessons" in geology wherever we travel, and, if we travel much, beginning with little more than the ability to read, gain a pretty full knowledge of the characteristics of the different formations, as seen at a little distance, and of the general character of surface that usually accompanies each. The notes accompanying the lists of stations are often very interesting reading, as witness the third in the New York list:

"New York Central & Hudson River Grades Caused by Geological Structure.—This railroad undoubtedly occupies the finest locality for an east-and-west railroad in the United States. From New York to Albany the road is level, tide water extending to Troy, the Hudson River being in fact an estuary. From Albany to Schoenectady there is an ascent of 200 feet; Little Falls is 368, Rome 439 feet, and Batavia (the highest station) 887 feet above tide. It has no heavy grades on its main line except at Albany and in the trough of the Genesee at Rochester. It owes its advantages to geological structure, the outcrop of the formations running east and west, and the Salina or Onondaga, Utica and Hudson River soft shales are cut into low valleys through which the railroad and Erie Canal are built. If the formations had run north and south, as they do in Pennsylvania, Maryland, etc., and been turned up edgewise, the hard sandstones would have been high ridges and perhaps mountains to be overcome, as they are everywhere from the Mohawk Valley to Alabama. If even the limestone ridge of the Helderberg range, which bounds this valley on the south, had taken a northern direction, as the 2-4 Cambrian formations do, a tunnel would probably have been necessary. In the western part of the state these Helderberg limestones continue, but not as a prominent ridge. The road *via* Geneva runs on them at Auburn, Clifton Springs, etc., but with less favorable grades than the direct road, and at Buffalo they are level with the plain. It should be added that the old Laurentian mountains at Little Falls and at Peekskill have been cloven from top to bottom, thus opening the gateways for the traffic and travel of the West. The popular impression that New York is a level plain like the prairies of the West, derived from traveling on the New York Central & Hudson River Railroad, is altogether erroneous. There is only a narrow trough through the centre of the state, in which the railroad and canal are located, that is of this level character."

In compiling his list of formations at stations, Mr. Macfarlane has had the assistance of the best geologists in the country, and of a great number of them (as indeed was necessary to give authority to this feature), including all the state geologists. It is certainly well calculated to give a great impulse to the study—at least, the elementary study—of geology, and especially by engineers and others engaged upon railroads.

RAILROAD EARNINGS IN DECEMBER.

NAME OF ROAD.	MILEAGE.					EARNINGS.					EARNINGS PER MILE.	
	1878.	1877.	Inc.	Dec.	P. c.	1878.	1877.	Increase.	Decrease.	P. c.	1878.	1877.
Atchison, Topeka & Santa Fe..	875	741	134	.....	18.1	\$323,500	\$246,778	\$76,722	.....	31.1	\$370	\$333
Burlington, Cedar Rapids & North Central Pacific..	434	424	10	.....	2.4	124,676	129,554	.....	\$4,878	3.8	287	306
Chicago & Alton.....	2,180	2,067	113	.....	5.5	1,438,000	1,354,882	83,118	.....	6.1	660	655
Chicago & Eastern Illinois.....	678	678	.....	.....	.....	350,249	316,800	33,449	.....	10.5	510	467
Chicago, Milwaukee & St. Paul.	1,729	1,412	317	.....	22.4	710,408	609,920	100,488	.....	6.9	411	474
Chi. & N. Western.....	2,078	1,993	85	.....	4.3	1,114,500	1,006,930	107,570	.....	10.7	536	505
Cleveland, Mt. Vernon & Del.	157	157	.....	.....	.....	29,981	29,000	981	.....	1.3	191	189
Indianapolis, B'ngton & Western.	343	343	.....	.....	.....	99,111	93,117	5,994	.....	6.4	289	271
International & Great Northern.	516	516	.....	.....	.....	222,078	196,155	25,923	.....	11.5	430	386
Kansas Pacific.....	673	673	.....	.....	.....	390,450	258,107	132,343	.....	9.9	587	584
Memphis, Paducah & Northern.	115	115	.....	.....	.....	18,106	19,432	.....	1,296	6.5	158	169
Missouri, Kansas & Texas.....	786	786	.....	.....	.....	242,568	256,021	.....	13,453	5.3	300	326
Nashville, Chattanooga & St. Louis.	349	349	.....	.....	.....	140,552	163,064	.....	13,512	8.3	429	467
Paducah & Elizabethtown.....	185	185	.....	.....	.....	24,098	30,698	.....	6,600	21.5	130	166
Philadelphia & Reading.....	800	800	.....	.....	.....	881,636	1,304,004	.....	422,368	32.4	1,102	1,630
St. Louis, Alton & Terre Haute, Belleville Line.....	71	71	.....	.....	.....	48,793	41,420	7,373	.....	17.7	659	583
St. Louis, Iron Mt. & Southern.	685	685	.....	.....	.....	472,110	526,304	.....	54,194	10.3	680	708
St. Louis, Kansas City & North W.	530	530	.....	.....	.....	279,905	258,085	21,820	.....	8.2	528	488
St. Louis & Southeastern.....	354	354	.....	.....	.....	100,032	91,303	8,729	.....	9.6	283	258
Southern Minnesota.....	213	170	43	.....	25.3	55,622	66,076	.....	11,354	16.9	261	304
Toledo, Peoria & Warsaw.....	237	237	.....	.....	.....	88,044	90,087	.....	2,043	2.9	372	383
Union Pacific.....	1,042	1,042	.....	.....	.....	854,155	795,083	59,072	.....	7.4	820	763
Wabash.....	688	688	.....	.....	.....	300,547	375,897	.....	15,350	4.1	524	546
Totals.....	15,877	15,175	702	.....	4.6	\$8,320,500	\$8,381,733	\$400,405	\$545,598	6.7	\$524	\$552
Total increase or decrease.....	.....	.....	702	.....	4.6	.....	.....	.....	55,193	0.7	.....	.....

RAILROAD EARNINGS, TWELVE MONTHS ENDING DEC. 31.

NAME OF ROAD.	MILEAGE.					EARNINGS.					EARNINGS PER MILE.				
	1878.	1877.	Inc.	Dec.	P. c.	1878.	1877.	Increase.	Decrease.	P. c.	1878.	1877.	Inc.	Dec.	P. c.
Atchison, Top. & S. Fe.	810	725	85	.....	11.7	\$3,930,847	\$2,679,105	\$1,251,742	.....	46.7	\$4,853	\$3,695	1,158	.....	31.4
Burlington, Cedar Rapids & Northern.	430	383	47	.....	12.3	1,527,067	1,249,881	277,186	.....	22.2	3,553	3,263	290	.....	8.9
Central Pacific.....	2,093	1,907	186	.....	9.8	17,752,363	17,050,976	701,387	.....	4.1	8,482	8,041	441	.....	5.1
Chicago & Alton.....	678	678	.....	.....	.....	4,080,820	4,464,343	225,477	.....	5.1	6,917	6,585	332	.....	5.1
Chicago, Mil. & St. Paul.	1,509	1,405	104	.....	7.4	8,451,707	8,114,894	336,813	.....	4.2	5,601	5,776	.....	175	3.0
Chi. & N. W.	1,988	1,789	199	.....	11.1	14,528,653	12,793,002	1,735,651	.....	13.6	7,778	7,151	627	.....	8.8
Cleveland, Mt. V. & Del.	157	157	.....	.....	.....	381,858	386,325	.....	\$4,467	1.2	2,452	2,461	.....	29	1.2
Dakota Southern.	81	78	3	.....	3.8	234,300	206,542	27,758	.....	13.4	2,893	2,648	245	.....	9.3
Des Moines & Ft. Dodge.	87	87	.....	.....	.....	211,028	148,434	62,594	.....	42.6	2,433	1,706	727	.....	42.6
Flint & Pere Marquette.	284	284	.....	.....	.....	1,036,017	970,606	65,411	.....	6.8	3,718	3,418	300	.....	8.8
Grand Trunk.....	1,390	1,389	1	.....	0.1	8,862,327	9,410,878	.....	554,551	5.9	6,376	6,780	.....	404	5.9
Great Western.....	511	511	.....	.....	.....	4,447,073	4,534,676	.....	87,603	1.9	8,703	8,874	.....	171	1.9
Ind. Bloom. & Western.	343	343	.....	.....	.....	1,260,947	1,209,663	51,284	.....	4.2	3,678	3,527	151	.....	4.2
International & Gt. Nor.	516	516	.....	.....	.....	1,025,444	1,500,455	.....	474,911	4.1	3,176	3,024	152	.....	4.1
Kansas Pacific.....	673	673	.....	.....	.....	3,729,600	3,294,549	435,051	.....	13.2	5,552	4,886	666	.....	13.2
Memphis, Paducah & N.	115	115	.....	.....	.....	186,324	189,584	.....	3,260	1.7	1,620	1,649	.....	29	1.7
Missouri, Kan. & Tex.	786	786	.....	.....	.....	2,981,679	3,174,320	.....	192,641	6.1	3,703	4,039	.....	246	6.1
Nash., Chattanooga & St. L.	349	349	.....	.....	.....	1,631,681	1,749,209	.....	117,528	6.7	4,675	5,070	.....	395	7.8
Pennsylvania.....	1,783	1,782	1	.....	.....	31,636,734	31,117,146	519,588	.....	1.7	17,744	17,402	342	.....	1.7
Philadelphia & Reading.	800	800	.....	.....	.....	12,809,144	14,396,349	.....	1,587,198	11.0	16,011	17,905	.....	1,984	11.0
Pittsburgh, Virginia & Charleston.	30	30	.....	.....	.....	135,909	129,019	6,890	.....	5.4	4,532	4,301	231	.....	5.4
St. Louis, Alton & T. H.	71	71	.....	.....	.....	502,807	517,978	.....	15,171	2.9	7,082	7,295	.....	211	2.9
St. Louis, Iron Mt. & So.	685	685	.....	.....	.....	4,518,236	4,500,422	17,814	.....	0.4	6,596	6,570	26	.....	0.4
St. Louis, K. C. & Nor.	530	530	.....	.....	.....	3,317,816	3,150,477	167,339	.....	5.3	6,290	5,944	346	.....	5.3
St. Louis & Southeastern.	354	354	.....	.....	.....	1,187,011	1,008,494	178,517	.....	8.1	3,353	3,103	250	.....	8.1
Southern Minnesota.....	181	170	11	.....	6.5	642,963	689,085	.....	46,122	6.7	3,552	4,053	.....	501	12.3
Toledo, Peoria & War.	237	237	.....	.....	.....	1,243,959	1,106,067	137,892	.....	12.4	5,249	4,669	580	.....	12.4
Union Pacific.....	1,042	1,042	.....	.....	.....	12,725,879	12,403,834	322,045	.....	1.9	12,213	11,500	713	.....	1.9
Wabash.....	688	670	18	.....	2.7	5,024,105	4,585,913	438,192	.....	9.6	7,302	6,845	457	.....	6.7
Totals.....	19,081	18,542	539	.....	2.9	151,234,624	146,979,509	\$6,863,656	\$2,008,541	.....	\$7,926	\$7,327	.....	1	.....
Total increase.....	.....	.....	539	.....	2.9	.....	.....	4,255,115	.....	2.9	.....	.....	.....	.....	.....

Supreme Court Decision in Pacific Railroad Cases.

In Washington, Jan. 27, the United States Supreme Court gave its decision in the case of the Union Pacific Company, appellant, against the United States, error from the Court of Claims. The following summary is telegraphed:

This was a suit brought by the Union Pacific Railroad Company in the Court of Claims to recover from the United States, under the acts of Congress of July 2, 1864, and March 3, 1871, one-half of the compensation due it for the transportation of mails, troops, supplies, and munitions of war, amounting in the aggregate to \$800,000. As a defense to this suit the Government set up a counter-claim, under the sixth section of the act of July 1, 1862, to 5 per cent. of the net earnings of said road from the date of its completion, Nov. 6, 1869, to Nov. 6, 1874, amounting to \$1,400,000. This claim the Union Pacific Company resisted, on the ground that its road was not completed in 1869, as alleged by the Government, but in 1874, and that the interest upon its indebtedness, as well as its running expenses, should be deducted from its gross receipts in computing the net earnings upon which the United States was entitled to receive a percentage. A trial in the Court of Claims resulted in a victory for the Government, that court holding the road was completed in 1869, and that the Government was entitled to receive the difference between half-compensation, which it admitted was due to the railroad company, and the full amount of its counter claim. From that decree the Union Pacific Company appealed. The questions presented to this court for decision are: First, when was the Union Pacific Railroad completed? Second, what should be included in the words "net earnings?" And, third, how and under what conditions are payments to be made? This Court, in a long and carefully prepared opinion, delivered by Justice Bradley, holds as follows:

First. That, although in one sense of the word a railroad is never completed, or never in such a way as to make further improvement or greater perfection impossible, there is no reason why the word "completed" should be construed to mean one thing in the fourth and fifth sections of the act of 1862 and another thing in the sixth section. If the road was completed in such a sense as to entitle the company to receive land grants and subsidy bonds from the Government, it was also completed in such a sense as to entitle the Government to demand and receive 5 per cent. of its net earnings. This conclusion is, in the opinion of the court, so obvious that it needs no argument. The findings of fact in the court below show that the company, through its President, made affidavit to the completion of both of the several sections of its road and its whole line prior to Nov. 6, 1869, and that upon the strength of these representations, and of reports made by commissioners appointed to examine the road, it was accepted by the President, and subsidy bonds and patents for land grants upon the whole were duly issued to the company. The latter is thus estopped by its own

action from pleading incompleteness. A stronger case of estoppel could hardly be presented.

Second. What should be included in the net earnings? The court holds, in reply to this question, that the earnings of the road should include all sums receivable by the company from the Government for services rendered, but not the income or profit derived from its lands; that in computation of net earnings there should be deducted from this gross sum the necessary expenses of operation and all expenditures for ordinary improvement and repairs, but not expenditures arising out of the company's land department, nor interest upon its bonded indebtedness. The latter, the court holds, is not properly chargeable against receipts in computing net earnings. While thus deciding against the company on this point, the court is clearly of opinion,

Third. That the net earnings thus computed are to be applied first to payment of the annual interest upon its first mortgage bonds, and not to the payment of the 5 per cent. claimed by the Government. The court holds this to be the legitimate effect of the Government's waiver of its own priority. Interest accruing on the first mortgage bonds is as rightly payable out of the net earnings as is the 5 per cent. due the Government. The net earnings are the fund out of which both are to be paid; but if the fund is adequate only to the payment of one, the interest on the first mortgage bonds has precedence; otherwise, the whole Government debt might be paid, to the exclusion of the first mortgage, which is admitted to have priority. Such a result would be manifestly absurd. The Government, however, may claim that if there is not a sufficient surplus of net earnings in one year to pay 5 per cent. due for that year, it may be carried over to a succeeding year and taken out of the surplus thereof. This position the court holds to be untenable. The statute makes the application an annual one. If the year produces net earnings sufficient for the purpose, the Government gets its 5 per cent.; otherwise it does not, and there the account ends. It was never intended that it should be carried over from one year to another.

In conclusion, the Court, after directing some modifications in the decree in the Court of Claims, sums up its decision of the principal question in controversy as follows: "If, with these modifications, it should be found that the net earnings in any one year were not more than sufficient to pay interest on the first mortgage bonds accruing in said year, then the company will not be decreed to pay any portion of said 5 per cent. of net earnings for that year; but, if the net earnings were more than sufficient to pay such interest, the excess only will be subject, as far as it will go, to the payment of said 5 per cent.; but the company will not be decreed to pay any more than said excess. The decree of the Court of Claims is reversed, with instructions to enter a decree conforming thereto."

Justice Strong read a dissenting opinion for himself and Justice Harlan.

In the similar case of the Central Pacific the Court holds it unnecessary to repeat the opinion, as the case involves the

same questions. It reverses the judgment of the Circuit Court for California, with directions to that Court to grant a new trial, and to be governed by the opinion in the Union Pacific case.

The Kansas Pacific case is, in like manner, remanded to the Kansas Circuit for a new trial.

Transportation in Congress.

In the Senate on the 23d:

Mr. Allison, of Iowa (by request), introduced a bill granting the right of way and depot grounds to the Sioux City & Pembina Railroad Company through the public lands of the United States, from Beloit, Ia., to the Missouri River, in the Territory of Dakota, at or near the mouth of White River. Referred to the Committee on Public Lands.

In the Senate on the 24th:

On motion of Mr. Thurman, of Ohio, Senate bill to extend the operation of the act of Feb. 27, 1875, to provide for settlement with certain Southern railroad companies, for one year, reported favorably from the Judiciary Committee on the 16th inst., was recommitted to that committee.

Mr. Sharon, of Nevada, presented resolutions of the Nevada Legislature praying for a law prohibiting alleged discriminations, exactions and extortions of the Central Pacific Railroad Company in that state. Referred to the Committee on Commerce.

Mr. Ferry, of Michigan, from the Committee on Post-Offices and Post Roads, reported amendments to the Post-Office Appropriation bill, similar to those attached to the Post Route bill of last session, which did not pass. The amendments were reported upon by a conference committee, but the report was not considered. These amendments authorize the Postmaster-General to readjust the compensation hereafter to be paid for transportation of mails on railroad routes, each railroad company to be paid according to space occupied and rate of speed maintained, and to divide mail matter into four classes. Referred to Committee on Appropriations.

In the Senate on the 28th:

Mr. Gordon, of Georgia, introduced a bill granting the right of way to the Atlantic & Mexican Gulf Canal Company of Georgia and Florida through the lands and waters of the United States. Referred to the Committee on Public Lands.

Mr. Mitchell, of Oregon, submitted a resolution instructing the Committee on Railroads to inquire into the expediency of authorizing railroad companies operating inter-state railroads to construct and operate lines of telegraph for commercial purposes. Agreed to.

In the House on the 28th:

On motion of Mr. Baker, of Indiana, the appropriation for mail transportation by railroad in the Post-Office appropriation bill was increased from \$8,715,000 to \$9,000,000, by a vote of 89 to 76, and the appropriation for transportation by steamboat was increased from \$750,000 to \$900,000.

Before the Senate Committee on Commerce on the 29th:

A hearing was had on the bill to regulate inter-state commerce, known as the Reagan bill. Mr. Patterson, of Pennsylvania, presented the arguments of the oil producers in favor of the bill and their claims for protection against railroad combinations. Mr. Totten, for the Pennsylvania Railroad, requested time to answer, and it was agreed to give the railroads concerned a hearing on Feb. 5. Mr. Elmer, said to represent the Chicago, Milwaukee & St. Paul, suggested that the bill be limited so as to apply only to the Pacific railroad companies, which were chartered by Congress.

In the House, on the 29th:

Mr. Foster, of Ohio, submitted an amendment to the Post-Office appropriation bill which repeals the proviso in the deficiency bill which forbids any increase in postal-car service beyond what existed Dec. 1, 1878. Adopted.

Mr. Hinton, of Virginia, another amendment which provides that no deficiency shall be created during the current year by placing postal cars on any line. Adopted.

The following bills were reported from the Committee on Commerce and passed:

Authorizing the Chillicothe & Des Moines Railroad Company to construct a bridge across the Missouri at Lexington, Mo.

Authorizing the Bloomfield Railroad Company to construct a bridge across the Wabash, near Miron, Ind.

General Railroad News.

MEETINGS AND ANNOUNCEMENTS.

Meetings.

Meetings will be held as follows:

St. Louis, Kansas City & Northern, annual meeting, at the office, in St. Louis, March 4.

Summit Branch, annual meeting, at the office in Philadelphia, Feb. 11.

Pennsylvania Canal, annual meeting, at the office in Philadelphia, Feb. 11.

Dividends.

Dividends have been declared as follows:

Mobile & Montgomery, 2½ per cent., semi-annual, payable Feb. 4.

Cedar Rapids & Missouri River (leased to Chicago & Northwestern), 3½ per cent., semi-annual, on the preferred, and 1 per cent., quarterly, on the common stock, payable Feb. 1.

Connecticut & Passumpsic Rivers, 1½ per cent., semi-annual, on the preferred stock, payable Feb. 1. The company also pays 1½ per cent. of the stock of the leased Massachusetts road.

Eel River, 2 per cent., payable Feb. 1. This is the first dividend on the stock, which represents the bonds of the former Detroit, Eel River & Illinois road.

Middlesex Central (leased to Boston & Lowell), 3 per cent., semi-annual, payable Feb. 1.

Pullman Palace Car Co., 2 per cent., quarterly, payable Feb. 15.

Republican Valley (leased to Burlington & Missouri River in Nebraska), 2 per cent., quarterly, payable Feb. 1. This is the first dividend.

Illinois & St. Louis, 2½ per cent., on the preferred stock.

Mail Service Extensions.

Mail service has been ordered over new railroads or extensions of old lines as follows:

Dannemora, service ordered from Plattsburg, N. Y., to Dannemora, 17.69 miles.

Denver, South Park & Pacific, service extended from Bailey, Col., to Grant, 11.40 miles.

Rio Grande, service ordered from Brownsville, Tex., to Brazos Santiago, 28.04 miles.

Western Association General Passenger & Ticket Agents.

The regular monthly meeting was held in St. Louis, Jan. 21, when it was decided that 150 pounds should be the limit of free baggage over their roads, also that no change could be made in the present manner of accommodating commercial travelers. A committee of seven was appointed on a

system of baggage checking, which shall enable the Audit Department to have as nearly as possible a perfect check at local and through baggage collections. If the report of the committee is adopted by the Association it will be presented to the National Association at its next meeting. A committee was appointed to report a contract ticket with uniform provisions and working, so that all future issue of tickets may be the same on all roads. The matter of special freight rates on emigrants' movables was laid on the table.

On the second day, Jan. 22, the first thing taken up was the report of the committee on the form of an iron-clad contract round-trip ticket. A new form was recommended, adopted, and will be printed for distribution. A resolution was adopted that the form of ticket be sent by the Secretary to the secretaries of all other General Passenger and Ticket Agents' Associations in the country, requesting that the form be adopted by them, so as to have a uniform system of round-trip contract tickets throughout the country.

A resolution was adopted as the sense of the Association that all tickets sold at less than the highest regular first-class rate be limited, and recommending the adoption of this rule to other associations.

The question of making a tariff of rates was thoroughly discussed. It was finally decided not to print any sheet of rates at this meeting, as the district sheets now being published would temporarily answer all purposes.

Cincinnati was agreed on for the place, and Feb. 12 as the time of the next meeting.

ELECTIONS AND APPOINTMENTS.

Atlantic, Mississippi & Ohio.—Mr. L. S. Brown is appointed General Traveling Passenger Agent, to date from Jan. 15.

Augusta & Savannah.—At the annual meeting in Savannah last week, the following directors were chosen: John Davison, William Duncan, John L. Hardee, Henry Hull, A. R. Lawton, George S. Owens, Ferdinand Phinizy. The board elected Henry Hull President. The road is leased to the Central, of Georgia.

Baltimore & Ohio.—The Baltimore City Council has elected the following city directors in this company: George R. Berry, William A. Boyd, Anthony Clark, Michael Coakley, Dr. D. P. Hoffman, J. B. Stafford, B. F. Uiman.

Bell's Gap.—Mr. Robert Ford has been appointed Superintendent, in place of Mr. Joseph Ramsay, Jr., who has gone to the Pittsburgh, New Castle & Lake Erie road.

Cincinnati & Eastern.—Mr. Stephen Feike has been appointed Receiver by the Clermont County (O.) Court.

Cincinnati & Fayetteville.—At the annual meeting, Jan. 6, the following directors were chosen: Wm. Roubush, Newtonville, O.; Silas J. Bivans, James Connolly, James Campbell, Fayetteville, O.; Luke Higgins, Logtown, O.; D. K. Harvey, Milford, O.; S. J. Rybolt, Mulberry, O.; James Clark, Belfast, O.; Wm. P. McCurdy, Eleanor, O. The board elected Col. Wm. Roubush, President; Silas J. Bivans, Vice-President; T. S. Murray, Secretary; Sylvester Shriner, Treasurer.

Columbus & Northwestern.—At the annual meeting in Urbana, O., Jan. 14, the following directors were chosen: Henry Carrill, R. G. Dun, D. W. Sowles, J. H. Anderson, E. Williams, T. J. Godfrey, A. L. Manning, J. N. Beach, L. Weaver, Joseph Sevan, Jr., E. Jennings, Joel Burnside, T. E. Miller. The board elected Edward Jennings, Vice-President; F. V. Sowles, Secretary; J. A. Jeffries, Treasurer.

Dayton & Southeastern.—At the annual meeting in Dayton, O., Jan. 14, the following directors were chosen: D. E. Mead, Daniel Keifer, W. P. Callahan, T. A. Legler, M. C. Allison, F. C. Treblein, A. J. Christopher, John L. Persinger, Daniel McLean, D. C. Anderson, Wm. J. Ingham, John C. Entekin, George C. Rittenour, H. G. Willard, F. S. Austin. The board elected D. E. Mead, President; Daniel Keifer, Vice-President; F. Sprague, Secretary; J. S. Ankeney, Treasurer.

Denver, South Park & Pacific.—Mr. C. W. Fisher has been appointed General Superintendent, in place of J. W. Nesmith, resigned. Mr. Fisher was recently Division Superintendent on the Kansas Pacific.

Elizabeth City & Norfolk.—Zephaniah Underwood, of Harveysburg, O., has been chosen President.

Fitchburg.—At the annual meeting in Boston, Jan. 28, the old board was re-elected as follows: Robert Cochran, C. U. Cotting, Wm. B. Stearns, Boston; Seth Bemis, Newton, Mass.; Rodney Wallace, Fitchburg, Mass.

Holyoke & Westfield.—At the annual meeting in Holyoke, Mass., Jan. 27, the following directors were chosen: J. C. Parsons, Wm. Whiting, G. W. Prentiss, T. Merrick, A. Strusberg, J. Delaney, M. Lynch, M. J. Teahan, R. P. Crafts. The board elected J. C. Parsons, President; Wm. Whiting, Vice-President; J. P. Buckland, Clerk; G. W. Prentiss, Treasurer.

Illinois & St. Louis.—At the annual meeting in Belleville, Ill., Jan. 16, the following directors were chosen: Robert Campbell, A. Meier, R. Sellen, N. Schaeffer, J. H. Branch, George Knapp, C. S. Greeley, G. A. Koerner, R. Hinckley, B. F. Switzer, J. F. Rentschler, J. Rainey, A. C. Hucker, W. E. Richardson, Thomas Winstanley. The board re-elected J. H. Branch, President; N. Schaeffer, Vice-President; P. T. Burke, Secretary and Treasurer.

Jacksonville, Pensacola & Mobile.—Mr. Edgar Vliet has been appointed General Freight and Ticket Agent. He was formerly on the Baltimore & Ohio.

Junction & Breakwater.—At the annual meeting in Milford, Del., Jan. 20, the following directors were chosen: Thomas Baumgardner, John Bodine, Benjamin Burton, John W. Causey, Harbison Hickman, Edward D. Hitchens, N. L. McCready, Henderson Moore, Charles C. Stockley.

Keokuk Northern Packet Co.—At the annual meeting in St. Louis, recently, the following directors were chosen: W. F. Davidson, John Shethar, Peter Conrad, P. S. Davidson, A. M. Hutchinson, R. C. Gray, Darius Hunkins, Thomas Griffith, James Ward. This board elected the following officers: President, Commodore W. F. Davidson; Secretary and Treasurer, Frank L. Johnson; General Superintendent, John F. Baker.

Logansport, Crawfordsville & Southwestern.—Mr. T. H. Malone having resigned the position of General Freight and ticket agent, Mr. W. H. Trueblood has been appointed in his stead. All communications relative to freight and passenger business should be addressed accordingly. Mr. H. C. Short is appointed Treasurer for the Receiver in place of Mr. Truesdale.

London & Fort Stanley.—At the annual meeting in London, Ont., Jan. 17, the following directors were chosen: F. Broughton, Samuel Barker, James Cousins, J. Carling, Robert Pritchard, Major Ellison, C. P. Smith, W. R. R. Street, James Egan. The board elected James Egan, President; C. P. Smith, Vice-President; W. Bowman, Secretary.

Long Branch & Sea Shore.—At the annual meeting in Long Branch, N. J., Jan. 25, the following directors were chosen: J. S. Coleman, M. S. Coleman, E. S. Conover, W. E. Conover, Jay Gould, R. S. Green, B. F. Ham, J. M. Ham, G. P. Morosini, Nehemiah Perry, Thomas G. Rigney, T. J. Sheridan, W. S. Sneden. The road is leased to the New Jersey Southern.

Montreal, Portland & Boston.—At the annual meeting in Montreal, recently, the following directors were chosen: S. T. Willett, Emmons Raymond, Lucius Robinson, T. W. Ritchie, R. N. Hall, W. K. Blodgett, Amos Barnes. The board re-elected S. T. Willett, President; R. N. Hall, Vice-President; Mr. Loneragan Secretary-Treasurer.

New Castle & Franklin.—At the annual meeting in New Castle, Pa., Jan. 13, the following were chosen: President, Cyrus Clarke; Vice-President, Jeremiah Bonner; Directors, George V. Boyles, A. L. Crawford, R. W. Cunningham, Wm. Y. Greer, B. McGoffin, S. R. Mason, A. P. Moore.

New York Elevated.—Mr. N. Guilford, Permanent Secretary of the Joint Executive Committee of trunk line and Western railroads, and formerly for several years General Freight Agent of the Baltimore & Ohio Railroad, has been chosen Vice-President of this company, and will be, it is understood, the active executive of the corporation.

New York, New Haven & Hartford.—Mr. Wm. L. Squire, of Hartford, Conn., has been chosen Treasurer, in place of Wm. A. Burroughs. Mr. Squire was for many years Paymaster of the old Hartford & New Haven Company, but for some years past has been Assistant Secretary of the Charter Oak Life Insurance Company.

Pittsburgh & Lake Erie.—At the annual meeting in Pittsburgh, recently, Mr. James I. Bennett was re-elected President, and the following directors chosen: Jacob Henrici, David Hostetter, John Reeves, M. W. Watson, James M. Bailey, Joshua Rhodes, Wm. M. Lyon, John F. Dravo, James M. Schoonmaker, J. H. Devereux, John Newell, Jacob Painter.

Providence, Warren & Bristol.—At the annual meeting in Providence, R. I., Jan. 27, the old board was re-elected, as follows: A. E. Burnside, T. P. I. Goddard, Wm. Goddard, Providence; Samuel W. Church, Bristol, R. I.; Wm. R. Robeson, Francis M. Weld, Henry A. Whitney, Boston. The board re-elected Henry A. Whitney President.

Rochester & State Line.—At the annual meeting in Rochester, N. Y., Jan. 28, the following directors were chosen: Oliver Allen, Samuel F. Barger, D. D. S. Brown, George H. Burrows, Edward Harris, Donald McNaughton, Augustus Schell, Allen D. Scott, James Tillinghast, William H. Vanderbilt, William K. Vanderbilt, Cornelius Vanderbilt, Edwin D. Worcester.

Sabine Pass & Northwestern.—At the annual meeting in Dallas, Tex., Jan. 15, the following directors were chosen: A. W. Acheson, Denison, Tex.; H. J. Snow, Kaufman, Tex.; J. Burwell, Lawrence, Tex.; J. R. Jones, Goshen, Tex.; W. G. Bell, Austin, Tex.; J. H. Rice, Washington; S. H. Robbins, Allentown, N. J.; W. B. Hotchkiss, New York; Baron de Pardonette, Paris, France. The board elected J. Burwell President; W. G. Bell, Vice-President; S. H. Robbins, Secretary; J. H. Rice, Treasurer.

St. Louis, Kansas & Arizona.—The first board of directors of this new company is as follows: Allen B. Lemmon, Winfield, Kan.; Wm. Spriggs, Garnett, Kan.; Alfred Ennis, Topeka, Kan.; Joseph L. Stephens, Boonville, Mo.; David K. Ferguson, Daniel R. Garrison, Isaac L. Garrison, Oliver Garrison, Webb M. Samuel, St. Louis; Francis R. Baby, Cornelius K. Garrison, Wm. R. Garrison, John P. Kennedy, New York.

Southwestern, of Kentucky.—Mr. N. Tabler has been chosen President, in place of L. P. McBraye, resigned.

Springfield & New London.—At the annual meeting in Springfield, Mass., Jan. 22, the following directors were chosen: Gurdon Bill, Charles O. Chapin, Horace Smith, Hinsdale Smith, H. W. Phelps, Virgil Perkins, L. J. Powers, M. H. Tourtelotte, Emerson Wight, Henry Fuller, James Kirkham, J. H. Appleton, C. L. Coville. The road is leased to the Connecticut Central.

Toledo & South Haven.—At the annual meeting in Paw Paw, Mich., Jan. 16, the following directors were chosen: F. B. Adams, Geo. W. Lawton, John Ihling, L. C. Hurd, J. C. Ford, M. Tillou, J. B. Johnson, J. W. Free, E. Martin. The directors re-elected F. B. Adams, President; J. W. Free, Vice-President; E. Martin, Treasurer; J. C. Ford, Secretary; J. Ihling, Superintendent.

United New Jersey.—Mr. Charles A. Butts has been chosen state director in this company by the New Jersey Legislature. He succeeds Wm. Patterson, who served two years. Mr. Butts was state director in 1875 and 1876.

Utica, Clinton & Binghamton.—At the annual meeting in Utica, N. Y., Jan. 22, the following directors were chosen: John Thorn, Isaac Maynard, Robert S. Williams, O. S. Williams, John E. Elliott, A. W. Mills, D. B. Miner, J. W. Forward, Geo. B. Phelps, Henry Hopson, D. B. West, Charles H. Smythe, W. M. Storrs. The board elected O. S. Williams, President; Isaac Maynard, Vice-President; J. W. Church, Secretary; W. H. Schuyler, Superintendent; O. S. Williams, Isaac Maynard, A. W. Mills, Executive Committee; J. E. Elliott, R. S. Williams, A. W. Mills, Committee in charge of street railroad.

Utah Southern Extension.—The first board of directors is as follows: Allan G. Campbell, Matthew Cullen, Millford, Utah; Wm. Jennings, Fernand Little, John Sharp, Salt Lake, Utah; S. H. H. Clark, Omaha, Neb.; Sidney Dillon, Jay Gould, New York.

Worcester & Nashua.—At the annual meeting in Worcester, Mass., Jan. 23, the following directors were chosen: F. H. Dewey, F. H. Kinnicut, Stephen Salisbury, J. Edwin Smith, E. R. Stoddard, Worcester, Mass.; Charles H. Walters, Groton, Mass.; John D. Bryant, Boston; Thomas Chase, Calvin B. Hill, Nashua, N. H.

PERSONAL.

—Mr. George B. Lake, Superintendent of Track, Bridges and Buildings of the Atchison, Topeka & Santa Fe Railroad, was married Christmas day at Big Rapids, Mich., to Miss Helen L. Marsh.

—Mr. H. E. Havens has resigned his position as General Superintendent of the Springfield & Western Missouri road.

—Col. John Fyffe, a well-known lawyer of Keokuk, Ia., and for many years Attorney for the Des Moines Valley Company and its successor, the Keokuk & Des Moines, died in Des Moines, Ia., Jan. 22, after a long illness.

—It is reported that Mr. Horace S. Smith, now Superintendent of the Joliet Iron & Steel Works, is to succeed Mr. John A. Jackman as Superintendent of Machinery of the Chicago & Alton.

—At a meeting of the board of directors of the Housa-

tonic Railroad Company, held Dec. 28, resolutions were passed expressing the regret of the board at the death of Mr. Charles A. Peck, for ten years a director of the company, their appreciation of his many good qualities, and their sympathy with his surviving family. Mr. Peck was also Agent for the Washburn, Hunts & Co. car-wheel foundry. From 1830 to 1853 he was an active and prominent dry-goods merchant in New York, and was well-known there.

—Mr. C. P. Atmore, General Passenger and Ticket Agent for the Louisville & Nashville, was married at Montgomery, Ala., Jan. 15, to Miss Estelle Williams, of that city.

—Mr. S. Sharpless Townsend, of the well-known manufacturing firm of Hoopes & Townsend, died, Jan. 23, at his residence, No. 1,721 Wallace street, Philadelphia, aged 51 years. Mr. Townsend was born in West Chester, Pa., but went to Philadelphia while still young, and worked for several years as a clerk. He then went to Wilmington, Del., where the firm of Hoopes & Townsend was established, and returned to Philadelphia when the works were removed there.

TRAFFIC AND EARNINGS.

Railroad Earnings.

Earnings for various periods are reported as follows:

Year ending Dec. 31:	1878.	1876.	Inc. or Dec.	P. c.
Cairo & St. Louis.....	\$219,213			
Chicago, Mil. & St. Paul.....	8,451,707	\$8,114,894	I.	330.873
Net earnings.....	3,659,454	3,574,401	I.	84.993
Dakota Southern.....	274,300	\$206,542	I.	27.758
Net earnings.....	113,539			
Des Moines & Fort Dodge.....	211,628	148,434	I.	63.194
Net earnings.....	75,806	18,796	I.	57.040
Pennsylvania.....	31,636,734	31,117,146	I.	519.588
Net earnings.....	13,167,741	12,088,679	I.	1,079,062
Six months ending Dec. 31:				
Bur. Cedar Rapids & No.....	\$734,137	\$834,232	D.	\$100,095
Net earnings.....	246,041	326,328	D.	80.287
Month of November:				
Grand Trunk.....	\$160,968	\$181,816	D.	\$14,848
Net earnings.....	41,273	45,014	D.	3.741
Month of December:				
Cairo & St. Louis.....	\$17,539			
Second week in January:				
Mo., Kan. & Texas.....	\$41,340	\$50,859	D.	\$9,519
St. Louis, Iron Mt. & Southern.....	75,719	101,582	D.	25.863
Third week in January:				
Chicago & Eastern Illinois.....	\$18,108	\$17,086	I.	\$1,022
Chicago, Mil. & St. Paul.....	138,000	191,460	D.	53.460
Hannibal & St. Jos.....	33,120	29,644	I.	3.476
Week ending Jan. 10:				
Great Western.....	\$50,248	\$93,114	D.	33.866
Week ending Jan. 18:				
Grand Trunk.....	\$176,526	\$181,484	D.	\$4,958

Cotton.

For the week ending Jan. 24 and the crop-year from Sept. 1 to that date, receipts were, in bales:

Week.....	1878.	1877.	1876.	1875.
Week.....	148,648	164,059	109,447	152,359
Crop-year.....	3,102,643	2,958,555	3,005,815	2,934,805

The receipts for the crop-year are thus the largest for five years.

The exports for two years have been:

Week.....	1878.	1877.	Increase.	P. c.
Week.....	158,940	114,008	44,932	37.0
Crop-year.....	1,837,224	1,930,709	216,515	13.4

Of the receipts from Sept. 1 to Jan. 17, the proportions at leading markets were:

	1878-79.	1877-78.
New Orleans.....	22.5	30.2
Savannah.....	18.7	15.5
Charleston.....	13.8	12.3
Galveston.....	13.8	12.5
Norfolk.....	12.6	12.2
Mobile.....	8.2	9.8

Although still behind, New Orleans is recovering its old rank as a receiver and exporter, interrupted by the yellow fever early in the crop-year. Its exports this year have been 24.2 per cent. of the total. Taking the year through, it usually exports about 40 per cent.

Grain Movement.

Receipts and shipments of grain of all kinds for the week ending Jan. 18 for the past six years are reported as follows, in bushels:

Years.	Receipts.	Shipments.	Receipts.
1874.....	2,919,179	1,215,756	1,783,547
1875.....	1,945,841	515,831	1,470,031
1876.....	2,328,469	1,032,381	2,094,592
1877.....	1,632,416	638,319	1,217,472
1878.....	4,158,086	1,797,007	3,275,956
1879.....	3,123,153	1,417,268	2,304,162

The Northwestern receipts for the week in 1878 were the largest ever known in winter; the week was the first of the winter when the roads were hard; before receipts had been kept back by the mud.

San Francisco receipts for the week ending Jan. 18 were 9,956 barrels flour, 147,113 bushels wheat, 21,158 bushels barley and 13,723 bushels other grain.

Coal Movement.

Coal tonnages for the week ending Jan. 18 are reported as follows:

	1879.	1878.	Inc. or Dec.	P. c.
Anthracite.....	298,584	272,791	I.	25.763
Semi-bituminous.....	41,970	44,172	D.	2.302
Bituminous, Pennsylvania.....	34,250			

The following statement shows the business of the seven companies in the anthracite combination for the year ending Dec. 31:

	Tonnage allotted, 1878.	Tonnage shipped, 1878.	Tonnage shipped, 1877.
Philadelphia & Reading.....	5,152,500	5,101,044	6,842,195
Lehigh Valley.....	3,555,000	3,398,717	4,511,331
Central of New Jersey.....	2,322,000	2,263,300	2,837,500
Del., Lackawanna & Western.....	2,295,000	2,180,672	2,089,523
Del. & Hudson Canal Co.....	2,246,400	2,045,041	1,918,017
Pennsylvania Railroad.....	1,372,500	1,362,674	1,530,594
Pennsylvania Coal Co.....	1,055,700	955,492	1,118,011
Total.....	18,000,000	17,306,910	20,847,681

Not one of the companies shipped up to its quota.

Shipments out of the pools on the Monongahela River above Pittsburgh in 1878 were: Coal, 2,797,530 tons; coke, 275,480 tons; total, 3,073,010 tons; total, 1877, 3,179,237 tons; decrease, 106,227 tons, or 3.3 per cent.

The coal tonnage to Pittsburgh of the Little Saw Mill Run Railroad for the year ending Dec. 31 was: 1878, 92,976

tons; 1877, 125,633 tons; decrease, 32,657 tons, or 26.0 per cent.

Southwestern Association Rates.

Commissioner Midgely's latest circular gives the following rates adopted at the last meeting, as follows, in cents per 100 lbs.:

Missouri River points to	Wheat.	Other grain.	Boxed meats and green hides.	Flour, per lb.
St. Louis.....	20	15	20	40
Chicago.....	25	20	20	50
Milwaukee.....	27 1/2	22 1/2	22 1/2	57
Toledo.....	33 1/2	28 1/2	30	67

The regular meeting of the Association was to be held in St. Louis, Jan. 29, when some new adjustment was possible.

Ocean Rates.

Rates are somewhat lower. Quotations from New York to Liverpool Tuesday of this week were: *By sail*, 5 1/2 d. per bushel for corn, 2s. per barrel for flour, 5 1/2 d. per pound for cotton, 23s. per ton for tallow, 12s. 6d. to 15s. per ton for measurement goods; and *by steam*, 3s. per barrel for flour, and 27s. 6d. per ton for flour in sacks, 30s. to 35s. per ton for provisions, 40s. per ton for butter and cheese, 32s. 6d. per ton for tallow and grease, 45s. per ton for leather, 1 1/2 d. to 1 3/4 d. per pound for cotton, 20s. to 25s. per ton for measurement goods, 4s. per barrel for oysters, and 3s. per barrel for apples.

Charters from New Orleans to Liverpool for cotton were made at 1 1/2 d. to 3/4 d. per pound by steam and 1 1/2 d. to 1 1/4 d. by sail—just about 50 per cent. higher than the New York rate.

To Cork for orders by sail charters are reported from New York at 5s. per quarter (480 lbs.) for grain, and from Baltimore at 5s. 4 1/2 d.

RAILROAD LAW.

Receiver's Liability for Old Debts of a Company.

Some time since the Jersey City Water Commissioners cut off the supply of water from the New Jersey Midland engine house, and refused to turn it on again unless the Receivers of the road would pay a bill for water supplied before their appointment. The Receivers then applied to the Chancellor for a *mandamus* to compel the Water Commissioners to continue the supply. The Chancellor has now decided that the old claims cannot be used as a barrier to the road as now organized, as it is run under the direction of the Court, and the old claims are against the company, which is not now in possession of the road. As a matter of equity, however, the Chancellor will take notice of an application by the city for payment of the old bill.

Jurisdiction over Foreign Corporations.

President Judge Thayer, in Common Pleas Court, No. 4, yesterday rendered a decision in the case of Eby vs. the Northern Pacific Railway Company. This was a rule to squash the writ and service. The company had been sued by Eby and a summons was served upon the President, who resides in this city. The office of the company is in the city of New York, and it has no office in Philadelphia, nor does it transact business here. The President of the company, however, resides in Philadelphia. In support of the rule, it was contended that the defendants are a foreign corporation, and that the act of Assembly which regulates the service of process upon such parties does not apply to corporations which have no office or place of business within the jurisdiction of the court and which transact no business in the state. In deciding the question, Judge Thayer said that the defendants owed their corporate existence and the franchises which they were entitled to enjoy by an act of Congress passed July 2, 1864, which empowered them to sue and be sued, plead and be pleaded in all courts of law and equity within the United States. A corporation, he said, has a legal existence everywhere within the limits of the sovereignty from which it derives its corporate life; that Pennsylvania is a constituent part of the sovereignty which incorporated the company, and it therefore had a legal existence in Pennsylvania. Having such legal existence in Pennsylvania, it was liable to be sued here if jurisdiction was obtained by service upon the proper officer of the company within the bounds of the court's jurisdiction, and there is no rule of common law and no statute which requires service on a corporation existing within the limits of the sovereignty from which it derives its powers to be made at the office or place of business of the company. As any person may be sued anywhere in the state where the summons can be lawfully served upon him, so a corporation which has a legal existence in Pennsylvania is in like manner liable to be sued anywhere in the Commonwealth where jurisdiction can be obtained by a proper service of the summons. The Judge, therefore, held that the service having been made upon the President of the corporation, who was the proper officer to be served, such service was good. The rule was discharged. —Philadelphia Times, Jan. 12.

Killing a Minor—Negligence.

In Nagle against the Allegheny Valley Company, just decided in the Pennsylvania Supreme Court, it was held as follows:

1. Upon an admitted state of facts, in cases of negligence as in other cases, it is the duty of the court to declare the law.
2. A failure to stop, look and listen before attempting to cross a railroad track is negligence *per se*.
3. An infant of fourteen years of age is presumed in law to have sufficient intelligence to be sensible of danger, and to have the power to avoid it.
4. This presumption can only be overcome by clear proof of the absence of such intelligence.

Damages for Injury—Contributory Negligence.

Sinclair against the Pennsylvania Company was a suit brought by an administrator to recover damages for the killing of a person on a line operated by defendant. The evidence established the fact that deceased negligently contributed to the injury which caused his death. The Indiana Supreme Court held as follows:

Something more than mere negligence, however gross, must be shown to enable a party to recover for an injury when he has been guilty of contributory negligence. Something more aggressive must be alleged and proven. When the injury complained of is a negligent one merely, contributory negligence is a good defense to the action. It is only where the injury sued for is alleged, either in terms or in substance, to have been willfully or purposely committed, that contributory negligence ceases to be a defense. By contributory negligence it is meant such as materially or substantially contributed to bring about the injury. As a matter of evidence, proof that the misconduct of the defendant was such as to evince an utter disregard of consequences, or as to imply a willingness to inflict the injury, may tend to establish willfulness on the part of the defendant; but, to authorize a recovery on such evidence, there must be suitable allegations in the complaint, to which it is applicable.

THE SCRAP HEAP.

Railroad Equipment Notes.

The Outer Depot car shops of the Fort Wayne Railroad have turned out a new car which possesses at least one point of great merit. This car is now part of a Leetsdale accommodation, and is so brilliantly lighted that fine print can be read in any part of the interior. Oil lamps are used, and the brilliant effect is produced by the use of silvered glass reflectors of peculiar device let into the ceiling over each lamp. In other respects the car is a great improvement over the old ones, the heating apparatus being particularly noticeable. —Pittsburgh Telegraph.

The Chicago, Rock Island & Pacific shops at Davenport, Ia., last year built 300 box and 12 caboose cars. They have now in hand three sleeping and six passenger cars and 50 flat cars.

The agency and management of the business of Washburn, Hunts & Co.'s car-wheel works in Jersey City are now under the charge of Mr. John B. Peck, as successor to his late father, Mr. Charles A. Peck. The firm name is Charles A. Peck's Son, and the office at No. 5 Dey street, New York.

The Baldwin Locomotive Works, in Philadelphia, have received several orders lately, including six engines to go to Brazil, and 17 for the New York Elevated road.

Iron and Manufacturing Notes.

J. A. Fay & Co., of Cincinnati, have just shipped to the Central Railroad of New Jersey a large machine for dressing car-sills. It finishes them perfectly on all four sides at one operation, saving the labor of a number of men.

The Mount Hickory Iron Co., Limited, is a new company which now owns the Erie Rolling Mill, at Erie, Pa., and Mount Hickory Furnace, at Sharpville, Pa. The capital stock is \$200,000, nearly seven-eighths being held by Wm. L. Scott, of Erie.

The Harlan & Hollingsworth Co., at Wilmington, Del., have recently taken contracts for an iron steamer of 2,000 tons burden, to run between Baltimore and Boston, and an iron ferry-boat, 150 feet long, for the Camden & Atlantic road, to run between Philadelphia and Camden.

The Laclede Rolling Mills, at St. Louis, turned out 12,000 tons of finished iron last year. They are now employing about 400 men.

The North Chicago Rolling Mill Co., which has for some time operated the Bay View Rolling Mill at Milwaukee, has leased also the blast-furnace connected with the works and will soon start it up. It has a capacity of 18,000 tons of pig-iron a year.

The rolling mill of W. D. Wood & Co., at McKeesport, Pa., is running full double turn.

Only five of all the rolling mills in Allegheny County, Pa., are now idle.

At the annual meeting of the Union Rolling Mills Co. in Chicago, last week, the following officers were chosen: President, A. B. Stone; Vice-President and General Manager, William Chisholm; Secretary, J. B. Stubbs. A quarterly dividend of 3 per cent. was declared.

At the annual meeting of the Cleveland (O.) Rolling Mill Co. last week, the following officers were elected: President, H. Chisholm; Vice-President, A. B. Stone; Secretary, E. S. Stone; General Superintendent, W. B. Chisholm.

The Kansas Rolling Mill Co., at Rosedale, Kan., is making the Lowrie draw-bar, and has orders from the Kansas Pacific and the Denver, South Park and Pacific roads.

Bridge Notes.

The Wrought Iron Bridge Co., of Canton, O., will pay a yearly dividend of 8 per cent. on the stock, Feb. 1. The company has just taken a contract for a highway bridge over Walnut Creek, near Macon, Ga.

Clarke, Reeves & Co., of Phoenixville, Pa., have taken the contract for the whole of the Metropolitan Elevated Railroad's new East Side line in New York. The line will be nearly eight miles long, and the structure will require some 27,000 tons of iron. This is the largest contract for bridge work ever given out. This order, with the work on the extension of the West Side line which Clarke, Reeves & Co. already have in hand, will make nearly 40,000 tons of iron spikes.

An exchange says that the President of a short railroad in western New York is also conductor, and upon occasion baggage-master, track-hand, etc. The other day he had to act as brakeman on an extra coal-train, and when he got home found the door shut against him. His wife explained, "I have been wife to the President, the conductor, the ticket-agent, and I don't know what besides, of this road, but I've got to draw the line somewhere, and I won't marry the brakeman."

The locomotive whistles a car-toon—and it draws many a car, too, says an exchange.

Speaking of a conductor on a local road, an Iowa paper says that it is "well worth \$8.25 to see Al. being polite to lady passengers."

A man with a rusty beard that ran down to a peak, and a rusty hat that ran up to a peak, boarded a Long Island Railroad train at Mineola, the other afternoon, took a seat near the stove and fell into a gentle slumber. In a few minutes a brakeman opened the door and shouted: "Queens!" The slumbering passenger slightly shifted his position and muttered: "The pot's yours; I stand in on jacks." —New York Sun.

French Opinions of the Reading Dust-Burning Locomotive.

Mr. A. Mallet, in describing the exhibit of locomotives at the Paris Exhibition in the *Revue Industrielle*, speaks as follows of the only American locomotive shown there, namely, the anthracite dust-burner of the Philadelphia & Reading Railroad:

"We have done our best to give our readers a sufficiently exact description of the general arrangement of this extraordinary engine, but we will not attempt to give them an idea of its forms in detail, and especially of the execution. The builders, not satisfied with having shown at the Exhibition this unique specimen of American locomotives, are, if we may trust the newspapers of the United States, about to exhibit it in various European countries. At this time the engine is on the Northern Railroad; thence it is to go to Switzerland, then to Italy. We do not know the rest of the programme; perhaps it includes Russia and the farthest East, and return by the Pacific, a trip around the world, this roundabout journey having for its end an energetic propaganda in favor of American ideas in the matter of locomotives. Without at all denying that there is something good to be drawn from transatlantic practice, we imagine that it is not the Philadelphia & Reading Railroad engine that will open the eyes of European engineers. At least, if they do open them, they will shut them again very quick when they see it."

The whole of which leads us to infer that M. Mallet did not entirely approve of the Reading engine.

The Heliotrope in Geodetic Surveys.

Professor L. M. Haupt describes, in the *Journal of the Franklin Institute*, the use of the heliotrope in reflecting the sun's rays to distant points, and thus facilitating the reading of angles, either horizontal or vertical, on lines of from

15 to 100 miles long. Its construction is so simple that it may be made by any school-boy with a penknife. Two opaque screens are placed about eighteen inches apart upon a strip of wood forming a base and screwed or nailed fast. A hole about one inch in diameter should be cut through each screen, the one in rear being a little larger than the other, and across each there should be drawn two fine wires or threads so as to intersect each other. About six inches in rear of the screens there should be placed a small mirror three inches in diameter will be sufficient—so mounted as to have the two motions horizontal (or in azimuth) and vertical (or in altitude). The crude instrument is then ready for operation. To throw the ray upon any given object visible to the unaided eye, turn the mirror down out of the way or remove it altogether, and sight across the wires, moving the base until the line joining the intersections of the cross wires passes through the object. Then replace the mirror carefully so as not to disturb the line of sight, and turn it in either or both directions until the shadow of the edge of the hole in the first screen is concentric with that in the second. The reflected ray will then be visible to an observer at the given point. Although so simple and inexpensive, this little instrument serves to increase greatly the economy and accuracy of reading angles to very distant objects. The rays reflected from it are plainly visible to the naked eye at from thirty to fifty miles, and with telescopes these "day stars" have been seen at a distance of nearly one hundred miles across Lake Superior when no trace of land was visible. By adopting any convenient code of long and short flashes made by obscuring the ray, messages may be sent from point to point. The Morse code is as convenient as any other, but for simplicity a conventional code expressing certain sentences by a few flashes is found to answer the ordinary requirements of field work.

Safety of Steamboat Travel.

A statement from Cincinnati says: "There were transported upon the Ohio River and tributaries above this city, for the past year, one million and a half of passengers, of whom five were killed and three injured."

Growth of Towns in Germany as Affected by Railroads.

The *Allgemeine Zeitung* publishes some figures relative to the influence of railroads on the increase of the town population of Germany. Of 2,528 towns of over 2,000 inhabitants only 887 in the year 1867 were provided with a railroad. In 1871 there were 1,049, and in 1875, 1,270. In the course of these eight years the total population of 2,528 towns rose from 8,418,000 to 12,424,000. Of 1,837 towns of from 2,000 to 5,000 inhabitants, in 1867 there were 1,388 without any rail communication. In 1871 they had fallen to 1,263, and in 1875 to only 1,065. Of 591 towns of from 5,000 to 20,000 inhabitants in 1867, 368 were without a railroad; in 1871, 218; and in 1875, only 162; while those provided with railroads increased from 323, with a population of 2,759,000, to 429, with a population of 4,000,000. Of the 88 towns of from 20,000 to 100,000 inhabitants all were provided with railroads in 1875. Their population increased from 2,750,000 to 3,500,000 during the interval in question. Of towns of more than 100,000 inhabitants, all, of course, also provided with railroads, the population increased from 2,050,000 to 2,665,000. The total increase of the population of the towns of more than 2,000 inhabitants from 1871 to 1875 was 1,511,000. The population of the whole German Empire only increased in the same period by 1,658,000. That is, nearly the whole increase was in railroad towns.

Long Trains of Cars Rotting in an Asiatic Wilderness.

The Peshawar correspondent of the *London Daily News* writes as follows: "On the road from Jhelum for some distance toward Rawil Pind there is visible a melancholy memorial of the dark ages. Alongside the Grand Trunk Road there still remains a section of the still-born, impossible, and preposterous narrow-gauge line which formed the so-called continuation of the railway system beyond Lahore. The broad gauge, or rather the normal gauge, has been completed as far as Jhelum, and there railway communication stops; but this ghastly limb of the dead corpse still, as I have said, stretches out some distance beyond Jhelum, a monument of folly, of good money literally thrown into the gutter, of insistence in blundering on the part of pertinacious imbecility. One passes well on to a mile of effete rolling-stock collected here apparently to rot. In his 'Narrative of a Besieged Resident,' Mr. Labouchere tells an amusing anecdote illustrative of the attachment to routine of the Paris postmen. The ordinary suburban distribution by mail-carts had just been stopped when he strolled into the court-yard of the General Post Office. Here stood the vehicles ready for the usual service, but unhorsed and without mails. But in each cart, through force of custom, the complement of postmen had taken their places, and there they sat, resignedly waiting for events. Of this story the spectacle of this spectral-train vividly reminded me. What hindered me to dismount from the rattle-trap of a dak gharry and take my place in the comparative luxury of this train? There was choice enough of accommodation in the hollow mockery. One vehicle bore the inscription, 'Family carriage,' another pretended to be a 'Traveling Inspector's carriage.' 'Native females' were provided for. Camels laden with ammunition tramped on their 12 days' journey to Peshawar, past conspicuously labeled 'powder vans,' in this melancholy ghost of a train. There was a long string of trucks which would have in two days cleared away that Ossa on Pelion of miscellaneous matter—stores, tents, gun cotton, shell-boxes, heaven knows what—that cumbered the neighborhood of the Jhelum terminus, and in its huge bulk seems to jeer at the efforts to diminish it by the means available for sending it on. For very shame's sake, had I any responsibility in connection with this unutterable fiasco, I would hustle somewhere out of sight this array of impossible rolling-stock; this flagrant witness to unparalleled perversity of folly. There are narrow-gauge railways elsewhere whose rolling-stock it would usefully supplement where whose rolling-stock it would usefully supplement. But of even this poor modicum of compensation reckless fatuity has prevented the realization. This long array of costly vehicles is a compulsory fixture. When Caesar crossed the Rubicon he burned his boats, but then his brilliant future gave the justification to the step. For these carriages, too, it is *nulla vestigia retrorsum*, for the reason that the line has been torn up behind it. Neither is there any onward, so that to rot *in situ* is their inevitable fate. Meanwhile the broad-gauge continuation, tardily substituted for the narrow-gauge abortion, is slowly progressing between Jhelum and Rawil Pind, and its completion to Peshawar or Kohat may be vaguely looked forward to in the course of the present century. It is unfortunate that at this latter point a break of gauge will probably occur, as the gauge obtaining on the Russian system differs from that in use anywhere else."

Singular Accident.

A singular accident occurred to a Cleveland, Mt. Vernon & Columbus engine on Tuesday. As it was running along between Holmesville and Millersburg, the tire on one of the drive wheels came off, and a piece about fifteen inches long was whirled up through the tender, tapping the water-tank

and causing a sudden emptying of its contents.—*Cleveland Herald.*

India Ink.

The *Papier Zeitung* gives the following recipe for making a deep-black India ink, which will also give neutral tints in its half shades: Rub thoroughly together eight parts of lampblack, sixty-four parts of water and four parts of finely-pulverized indigo. Boil the mixture until most of the water has evaporated, then add five parts of gum-arabic, two parts of glue, and one part of extract of chicory. Boil the mixture again till it has thickened to a paste; then shape it in wooden molds which have been rubbed with olive or almond oil.

Railroad Wages in England.

On the occasion of the strike during the first half of January, the Midland Railway Company advertised as follows: "The Midland Railway Company have vacancies for a number of steady men qualified to act as goods guards and other having railway experience who are willing to be trained for such duties. The conditions of service of goods guards are as follows: Under guards in country, 20s. (\$4.87) per week, with clothing; ditto in London, 23s. (\$5.60) with clothing; head guards from 24s. to 30s. (\$5.84 to \$7.30) per week, with clothing. When the men are required to sleep from home 2s. (48 cents) per night in the country and 3s. (72 cents) per night in London is allowed for lodging expenses. The men will work either on the time system or on the trip system, as may be required by the company. When working on the time system 66 hours to constitute a week's work, all overtime to be paid at the rate of 11 hours per day. The payments for men working on the trip system are carefully calculated upon the average time occupied by each trip. If the trains are unavoidably detained by circumstances beyond the guard's control an allowance will be made for extra time. The men to give and receive a fortnight's notice before leaving the company's service. Application to be made to E. M. Needham, Superintendent of the line, Midland Railway, Derby, Jan. 4, 1879."

A Heavy Freight.

Mr. M. T. Bass, the great Burton brewer, paid something more than \$700,000 for freight to the Midland Railway in 1878, and we believe that there are one or two other railroads that get a share of his traffic. He also owns about \$500,000 in the shares of the company; but he seems more anxious to cultivate the good will of the employees than of the company. He publishes the organ of the "Amalgamated Society of Railway Servants," and on the occasion of the recent strike on the Midland, he wrote a letter to the General Manager condemning the reduction of wages which was the occasion of the strike.

Shops of the Mexican Railroad.

A correspondent of the *Chicago Inter-Ocean* describes as follows the shops of the Mexican Railway (Vera Cruz to Mexico), which are at Orizava:

"We were courteously met by Mr. Grover, a native of Pennsylvania, the chief car-builder of the road, and he answered all our inquiries freely and intelligently. The car-shop proper is 60 x 200 feet in extent; the machine shop, 300 feet square, while the round-house is smaller, being but 30 x 200 feet. Here are housed and repaired seventeen Fairlie engines, used on the road from Vera Cruz to Esperanza. These engines are made in England, and weigh, with wood and water, about seventy tons, and were imported at a cost of \$80,000 each. They consist of two engines, put together with the boilers joined, fire-box in the centre, two cylinders at each end, and in front and rear a smokestack. There is a six-wheel truck under each end like an American car. There are in use on the road, from Esperanza to the city of Mexico, two Baldwin and five Roger engines, made in the United States. There are also two old-style engines, made by Danforth, Cooke & Co., of Paterson, N. J., in use at Vera Cruz."

"In the shops all the wood-work of car-building is done. The lumber is brought from the state of Mississippi principally. The reason Mexican timber is not used is because the large woods fit for the purpose will not stand the weather, the best native pine rotting in about a year, besides being subject to destruction by an insect that perforates it in all directions till nothing is left of it. There are plenty of splendid hard woods fit for ties, but not large enough for car building, except for finishing. Mr. Grover showed us ties of the finest rosewood, sabbie, balsam, and other timbers, such as are susceptible of the highest polish, and very valuable for furniture, if they were taken to the factories of the United States. The Mississippi lumber imported is oak, pine and cypress chiefly. There is some cedar and pine found here that is used for certain purposes, and lasts well, when not subjected to a succession of wet and dry seasons. The wheels for the cars are brought from England, the axles both from the United States and Great Britain and the springs from the States, being made principally at Pittsburgh. Mexico produces some of the finest iron ore in the world, but coal is so dear that it cannot be profitably smelted. All that is manufactured is by the use of charcoal, which is too expensive. There is a native iron found in Durango that can be forged at once in its natural state, it is so pure; but this, like everything else in Mexico, needs development. Coal is found at Tuxpan, near the coast, north of Vera Cruz, and should the mines prove as rich and extensive as they are reported, have only to be worked to make fine iron an article of export rather than import into Mexico."

"The company employs 500 men in and about the shops and station at Orizava. The laborers, or Peons, receive fifty cents per day; carpenters, \$1 to \$4 per day; foreign machinists, \$3 to \$5 per day, and native machinists, \$1 to \$3. The better class board for \$4 to \$7 per week, while the natives live for about 37½ cents per day."

"The rails are principally of iron, but are being replaced by steel, imported from England and the United States. "The engines burn wood, which is bought of the Indians, who bring it down from the mountains, already cut up for use, on the backs of mules. They are paid \$2.50 a cord for it, though sometimes the price has gone up as high as \$8. They bring down the ties in the same way, for which they receive about six rials, or seventy-five cents, a piece. The wood is burnt through pure maliciousness, as was the case with 200 cords at one depot, during the revolution two years ago."

"The cars are built on the American style, chiefly, except the second class, which are made in the English compartment plan. Mr. Grover showed us a fine lot of new machinery, lately put in for doing wood-work, that all came from the United States. He said he had much more to show and explain to us, but the swartzy engineer blew his whistle impatiently, and we were off at last for the land of Anahuac."

OLD AND NEW ROADS.

Atchison & Nebraska.—The round-house and shops lately burned at Atchison, Kan., are to be rebuilt, with several improvements. Besides the round-house there will be a machine-shop of stone, a carpenters' shop and a store-house and office.

Baltimore & Ohio.—The bridge over Wheeling Creek, in Wheeling, was carried away by the ice Jan. 28, causing a small loss. A passenger train had passed over the bridge but a minute before it fell.

By agreement between this company and the Pittsburgh, Cincinnati & St. Louis, a connection is to be put in between the tracks of this road and the Pittsburgh, Wheeling & Kentucky in Wheeling, W. Va., so that cars can be transported. The tracks have been separated by only a few feet.

Baltimore & Delta.—Ground was broken for this road at Belair, Md., Jan. 28, with much ceremony, a large number of people interested in the road being present. It is to run from Baltimore northward to Delta, Pa., about 45 miles.

Belleville & El Dorado.—It is said that the St. Louis, Alton & Terre Haute company has consented to advance the money needed to complete this road from its present western terminus at Benton, Ill., to Du Quoin, where it will connect with the Terre Haute road. The distance is about 18 miles. Some of the bridge work is already in progress and the grading will be begun as soon as the weather permits.

Black River.—It is said that arrangements have been made to complete this road early in the spring. It is already partly graded and some bridges built. The line is from Neillsville, the county seat of Clark County, Wis., southwest to Merrillan, where it will connect with the Green Bay & Minnesota and the Chicago, Milwaukee & St. Paul roads. The distance is 13 miles.

Boston Hoosac Tunnel & Western.—It is said that the trouble about the right of way over the Hart estate at Schaghticoke Point, N. Y., has been settled. The short gap in the road there can soon be closed, and in a few days trains can run through between Mechanicsville and Eagle Bridge.

Boston & Lowell.—This company is making surveys for the extension of its leased Middlesex Central road from Concord, Mass., to Maynard. The distance is about three miles.

Canada Central Extension.—This road, which is subsidized by the Canadian Government, is to extend from Pembroke, Ont., westward toward the proposed eastern terminus of the Canadian Pacific, about 120 miles. Work has been in active progress during the past season, and some 25 miles have been graded and bridged. Construction is in progress on about 40 miles more.

Chicago & Lake Huron.—The *Detroit Post and Tribune* says: "A quiet fight for the possession of Chicago & Lake Huron Railroad Receiver's certificates is progressing. Several parties are advertising for them, and offer 60 and 70 cents on the dollar."

Chicago, Milwaukee & St. Paul.—The following statement is made for the year ending Dec. 31:

	1878.	1877.	Increase.	P. c.
Gross earnings.....	\$8,451,767	\$8,114,804	\$336,973	4.2
Expenses.....	4,792,313	4,540,434	251,879	5.5
Net earnings.....	\$3,659,454	\$3,574,460	\$84,994	2.4
Per cent. of expenses.....	56.71	55.95	0.76	1.4

After allowing for 1878 interest, rentals and other fixed charges, and dividends of 7 per cent. on preferred stock, there would remain a balance of \$621,460, or sufficient to pay about 3½ per cent. on the common stock.

Chicago & Northwestern.—The following is a revised official statement for the half-year ending Nov. 30:

	1878.	1877.	Inc. or Dec.	P. c.
Passengers.....	\$1,814,532	\$1,761,586	\$52,946	3.0
Freight.....	5,753,908	5,686,905	67,003	1.2
Other sources.....	364,338	300,676	63,662	17.7
Total.....	\$7,932,833	\$7,749,167	\$183,666	2.3
Expenses and taxes.....	3,892,634	3,947,850	55,216	1.4
Net earnings.....	\$4,040,204	\$3,801,317	\$238,887	6.0
Interest, rentals, etc.....	2,425,794	2,430,694	4,900	0.2
Balance.....	\$1,614,410	\$1,370,623	\$243,787	17.0
Dividend, 3½ per cent. on preferred stock.....	753,284	753,284	.....	.....
Surplus.....	\$861,126	\$617,339	\$243,787	37.5

The expenses were 48.07 per cent. of earnings in 1878, and 50.89 per cent. in 1877. A dividend of 2 per cent. on the common stock was paid Dec. 28, being taken from the surplus remaining May 31, 1878.

Chicago, Rock Island & Pacific.—Iowa papers report that this company has agreed to build the Des Moines & Villisca road, which is to run from Winterset, Ia., on the Rock Island's branch line, southwest to Villisca on the Chicago, Burlington & Quincy, about 60 miles, provided a reasonable amount is raised along the line. The proposed line runs diagonally across the country lying between the two roads, and will carry the Rock Island into the Chicago, Burlington & Quincy's territory, as that company's Indianola Branch is taking it into the Rock Island's.

Chicago & Tomah.—This company has just completed its main line to Fennimore, Wis., about 30 miles southwest from the Chicago, Milwaukee & St. Paul crossing at Woodman. This line leaves the road from Woodman to Lancaster, whose completion was previously reported, at a point some 15 miles south of Woodman. The 16 miles completed from the junction to Lancaster is a branch of the main line.

Cincinnati & Eastern.—The Clermont County (O.) Court has appointed Stephen Feike Receiver of this road on application of W. R. McGill, a creditor. The company states that its embarrassments are due to the failure of subscribers to the stock to pay up their subscriptions when called for. The road is of 3 feet gauge, and is in operation from Batavia Junction, O., to Winchester, 48 miles.

Columbus, Chicago & Indiana Central.—The suit of Brown against the Pennsylvania Railroad Company was argued before the New York Supreme Court this week. The suit was brought to recover the amount of certain unpaid coupons from the Pennsylvania as guarantor. The company put in a demurrer that the contract or lease of the road made to the Pittsburgh, Cincinnati & St. Louis, and guaranteed by the Pennsylvania, was a contract between the companies only; that the guarantee was to the company alone and not an agreement which could be enforced by an individual bondholder. Argument was on this demurrer.

Dayton & Southeastern.—Receiver Gimperling reports as follows for December:

Receipts to Dec. 1.....	\$28,370.83
for December.....	9,161.95
Total.....	\$37,532.78
Working expenses, 55 per cent.....	\$20,688.85
Miscellaneous expenses.....	1,639.80
Betterments.....	5,051.28
Balance, Jan. 1.....	\$9,252.75

The working expenses for December were \$4,491.46; mis

cellaneous, for rentals of track and cars, \$513.80. The chief betterment expenses were for 10 new cars, ballasting, iron, side-tracks and fencing.

Decatur & State Line.—Local papers report that the contract for building this road from Strawn, Ill., to Chicago has been let to Ralph Plumb, and that he is already shipping ties from Southern Illinois. This is the road which is to form, with the Chicago & Paducah, the new line of the Wabash to Chicago.

Denver, South Park & Pacific.—This road is now completed to Grant, Col., 66 miles southwest from Denver, and seven miles beyond the old terminus at Slaght's. Trains are running regularly to the new terminus.

The New York American Exchange gives the following statement of the terms of the contract between this company and the Atchison, Topeka & Santa Fe:

"The contract provides for the purchase by the Atchison, Topeka & Santa Fe Railroad Company from the Denver & South Park Construction & Land Company, which has charge of the building of the Denver, South Park & Pacific Railroad, at par and accrued interest, of \$700,000 of the 7 per cent. gold first-mortgage bonds of the last-named road. The purchase money is to be deposited with the Farmers' Loan & Trust Company, of New York, and is to be applied, first, toward the payment of the outstanding indebtedness of the construction company, and second, to complete the construction and equipment of the Denver, South Park & Pacific Railroad. The Atchison, Topeka & Santa Fe Company receives \$700,000 of the capital stock of the Denver, South Park & Pacific Company, in order to maintain its control of that company. The issue of the first-mortgage bonds of the South Park Company is limited to \$1,800,000, the \$700,000 bonds received by the Atchison, Topeka & Santa Fe being deemed canceled and destroyed.

"To guarantee the construction of the South Park Railroad \$350,000 first-mortgage bonds of the company are to be pledged to the Atchison Company, and deposited with the Farmers' Loan & Trust Company. The contract also provides that whenever the Pueblo & Arkansas Valley Railroad (which practically is part of the Atchison, Topeka & Santa Fe road) shall be extended from its point of intersection with the Denver, South Park & Pacific road, near Trout Creek, on the Arkansas River, to Leadville, or any points beyond that place, the South Park Company shall have the right of joint trackage over the extension upon the payment of a monthly rental of 8 per cent. per annum on one-half of the actual cash cost of the construction of the track so far as used. The right of joint use of track upon the same terms over any extensions constructed by the Denver, South Park & Pacific Company connecting with the Pueblo & Arkansas Valley road is also confirmed to the Atchison, Topeka & Santa Fe Company. All extensions to the San Juan mining region by either the South Park or the Pueblo & Arkansas Valley Company are also to be subject to the same provisions of the agreement, which are to be perpetual. The tracks thus used in common are to be kept in repair at the joint expense of the two contracting railroad companies according to the traffic of each company upon the tracks so jointly used.

"The contract also provides that uniform rates shall be established for all competitive business west of Denver and Pueblo, to be fixed by mutual agreement. The receipts from all competitive business west of these places are to be pooled upon the following basis: After deducting and reserving to each railroad company 50 per cent. of its respective receipts accruing by reason of such business, the remainder is to be pooled and divided monthly, share and share alike, and any differences due from the one road to the other from any and every month's receipts, is to be accounted for and paid over within 30 days after the end of each month. The pooling arrangement is to continue in force for 25 years from the date of the agreement. In conclusion, it is stipulated that both the Pueblo & Arkansas Valley, and the Denver, South Park & Pacific railroads shall be completed and equipped to the point of their junction near Trout Creek on or before July 10, 1879."

It is said that Mr. L. H. Meyer, Trustee for the Denver & Rio Grande bondholders, refuses to give his assent to the contract unless a supplement can be added to the lease of his road to protect the bondholders. His reasons are that when the projected new lines are finished the Denver & Rio Grande will be entirely shut in and at the mercy of the lessee, and that a great part of its traffic can be diverted from it, should the lessee so desire, leaving it with earnings entirely too small to pay interest. He desires to secure the bondholders against the possibility of such action.

Detroit, Grand Haven & Milwaukee.—This company, successor to the Detroit & Milwaukee, has duly executed and recorded the mortgages called for by the plan of reorganization. The first is for \$2,000,000, to secure that amount of 40-year 6 per cent. bonds, and the second for \$3,200,000, to secure the same amount of 5 per cent. bonds. Both are dated Nov. 14, 1878, and the trustees under both are Samuel Laing, of London, England; Edward Martin, of Hamilton, Ont., and John Owen, of Detroit, Mich. The bonds issued are to be guaranteed by the Great Western, of Canada.

East Alabama & Cincinnati.—Negotiations are in progress for the transfer of this road to the Central, of Georgia, and its extension from the present terminus at Buffalo, Ala., northward some 30 miles to Wedowee in Randolph County. It is now in operation from Opelika to Buffalo, 22 miles.

Elizabeth City & Norfolk.—A new contract for the completion of this road has been let to Zephaniah Underwood, of Harveysburg, O., who is also chosen President of the company. The former contractor, Mr. Chandler, has applied for an injunction to prevent the transfer of the contract, unless certain claims of his are paid.

Grand Rapids & Indiana.—This company has contracted for steel rails enough to lay 40 miles of track. They will be put down the coming season, about one-half south of Grand Rapids and the other half north of that place.

Green Bay & Minnesota.—Receiver Case, besides paying all wages and current expenses, has been able to apply some money to the improvement of the road. He recently bought 550 tons of steel rails to be used in renewals of track next spring. The passenger cars are being fitted with the Blackstone platform and coupler, and two new locomotives have been ordered from the Dickson Company.

The road is now carrying a large quantity of ties for the Winona & St. Peter road. They come from Northern Michigan to Green Bay by lake, and are carried over this road to Winona.

Hannibal & St. Joseph.—This company gives notice that the Quincy & Palmyra bonds, the principal of which falls due Feb. 1, will be paid on presentation at the Bank of North America in New York.

Konkapot.—This project, for which a charter was obtained several years ago, has been revived, and much local interest is taken in it. The line is from Mill River, Mass.,

through the Konkapot Valley to Canaan, Conn., about eight miles. The road is very easily built, it is said, and contractors have offered to grade it for \$1,000 per mile.

Lafayette, Muncie & Bloomington.—In the matter of the decree of foreclosure against this road, the United States Circuit Court has referred to a master for examination the question whether the whole road can be sold as one property, in such a way as fully to protect the rights of the holders of bonds secured by the mortgage on the Western Division. There is no question as to granting the decree, the only points being as to its form, and whether the whole road shall be sold together.

Lehigh Valley.—At the recent annual meeting, President Packer made the following statements as to the anthracite combination:

"The past year has been an exceptional one in the history of this company. Early in the season the shippers of anthracite coal over our railroad united with all the other coal-carrying companies and individual operators in an arrangement intended to regulate the production and apportion the tonnage among the several lines.

"Although not in any way a party to this association, yet the effect was the same, as the several coal companies in which we are interested acted with the others. The result is shown, not only in the greatly reduced total tonnage of anthracite coal carried by us, but also in the disproportionately great decrease of through coal carried to Perth Amboy. The whole amount assigned to us being fixed, any increase of one portion of our trade necessitated a reduction of another. The iron furnaces and other markets along the line of our road required, during last year, 115,027 tons more than the year before. This passed over but about one-third of our road below Mauch Chunk, and could only be supplied by taking it from that which would otherwise have gone to tide-water, and paid toll over an average of three times the distance. The injurious effect upon our revenue was, therefore, much greater than would appear from the mere difference of totals. Our operators have so far declined to enter upon a similar arrangement for the present year."

Little Rock & Fort Smith.—This company having been ordered to remove so much of its track as was in the Cherokee Country in the Indian Territory, has taken up all the track (about two miles) on the north side of the Arkansas River from the Arkansas state line to the old terminus at Cherokee station, opposite Fort Smith. The track has been relaid on the south side of the river in Arkansas, and arrangements made to ferry trains over the river on a transfer boat at State Line station, so that they will run directly into Fort Smith. The transfer of the track was very quickly made, taking but a few days.

Long Island.—Receiver Sharpe gives notice that the coupons due Nov. 1, 1878, on Long Island first-mortgage bonds, Flushing & North Side first-mortgage, Newtown & Flushing and Far Rockaway Branch bonds, will be paid after Jan. 29 by Drexel, Morgan & Co., New York.

Maine Central.—A bill is before the Maine Legislature to prohibit the voting of stock in Maine companies held by foreign corporations. This is especially intended to take the control of the Maine Central out of the hands of the Eastern Railroad Company. A committee hearing on the bill was to be had this week. It is difficult to see how such a bill can be passed, and if it should pass, it could be easily evaded.

Massachusetts Central.—The Boston Advertiser says: "The money necessary to complete the Massachusetts Central Railroad, from Arlington to Hudson, \$400,000, has been placed at the disposal of the contractor, N. C. Munson, and the Boston & Lowell road has agreed to operate this section of the road when completed. In order to do this more effectively it will lay a double track on its Arlington Branch before October next. The completion of the Massachusetts Central, making with the Burt connection, a second through tunnel route, will probably be accomplished in 1880."

Metropolitan Elevated.—The contract for the line which this company is authorized to build on the east side of New York from the Bowling Green to Harlem, by way of Second avenue, has been let to Clarke, Reeves & Co. The line is nearly eight miles long, from the Bowling Green, near the lower end of the city, through Beaver and Pearl streets, the New Bowery, Division and Allen streets and First avenue to Twenty-third street, through that street to Second avenue and up Second avenue to Harlem. A short section of the line through Pearl street and the New Bowery will be on the track of the New York Elevated road.

Metropolitan (London).—This underground city railroad reports the number of passengers carried, and the gross receipts for the last four years as follows:

	1878.	1877.	1876.	1875.
Passengers.....	58,807,038	56,175,753	52,580,395	48,302,324
Receipts.....	£494,873	£490,828	£475,792	£448,364

The receipts were chiefly from passengers, but there was also something from tolls and freight transfers. For the half-year ending Dec. 31, 1878, the receipts were: From traffic, £243,101; other sources, £160,763; total, £250,864; expenses, £290,403; net receipts, £160,461. After paying interest on debentures and dividends on preferred stock, enough was left to pay an annual dividend of 5 per cent. on the common stock.

Minneapolis & Northwestern.—This company has filed articles of incorporation in Minnesota covering the following lines:

First—A line connecting Minneapolis with, and extending into the country lying between Hastings & Dakota road and the First Division of the St. Paul & Pacific main line, then southerly and westerly toward the west line of the state of Minnesota, with branches, etc., as the board of directors may think best, to be known as the Southern Division of said road.

Second—A line connecting Minneapolis with and extending into the country between the main line of the First Division of the St. Paul & Pacific road and the St. Vincent Extension of the St. Paul & Pacific; thence westwardly and northwardly toward the western boundary of the state, with such branches as may be directed by the board of directors, to be known as the Central Division of said road.

Third—A line connecting Minneapolis with the country northerly of the St. Vincent Extension of the St. Paul & Pacific, thence northerly toward the northern boundary of the state, with such branches as the board of directors may direct, to be known as the Western Division of said road.

The capital stock is fixed at \$250,000, to be paid in as the board of directors may determine upon, but never shall over 5 per cent. be called for in one month.

Morgan's Louisiana & Texas.—The New Orleans Picayune says that all the contracts for completing the railroad from Sabine River to Morgan City have been signed. By these contracts, made between the Morgan Company and the Texas & New Orleans Company and a third party, the connection must be made before the expiration of eighteen months from the month of November, 1878. Steel for the road to Vermilionville is constantly arriving and also new engines and necessary rolling-stock. An increased number

of laborers will at once be put on the road beyond Morgan City, and it is stated that trains will be running to Houston in less than fifteen months.

New York, Lake Erie & Western.—Argument was heard in Buffalo, before the Supreme Court, last week, in the suit of Woodruff against this company, which is brought to recover interest from January, 1875, on \$120,000 bonds of the Erie & Genesee Valley road. The road was turned over to the Erie under a lease in 1871, and interest on the bonds paid for four years, when further payment was refused, though trains were still run over the road. It extends from Mt. Morris, N. Y., to Dansville, 12 miles.

Northern Pacific.—A dispatch from Bismarck, Dak., Jan. 22, says: "The contractors are expected this week, and work on the extension will be inaugurated at once. The railroad officials will erect a temporary bridge over the Missouri for the immediate transportation of ties and iron. Twenty-five hundred tons of iron were purchased in Springfield, Ill., by Acting Chief Engineer Rosser, deliverable in Minneapolis on the cars, at \$38 per ton. Shipments of this iron will begin this week. Ten pile bridges over the circuitous Heart River will be put in this winter. That will be the principal work of the contractors before spring. The company have purchased 9,000 tons of steel rails for the Minnesota Division, from Sauk Rapids to Fargo. They will be put down early in the season. The division west of Bismarck will be named Missouri."

Ohio & Mississippi.—Receiver King reports for December as follows:

Balance Dec. 1.....	\$212,400.13
Receipts.....	431,078.75
Total.....	\$643,547.88
Disbursements.....	602,941.20

Balance Jan. 1.....\$40,006.68
The disbursements were \$171,862.45 greater than the receipts for the month.

Passes in New Hampshire.—Several of the New Hampshire roads have combined to stop or limit the issue of passes, of which a very great number have usually been given. The Boston, Concord & Montreal, the Northern, the Concord & Claremont, and the Peterboro' & Hillsboro have agreed to issue no more. The Concord will limit its free list to the Supreme Court judges and a few other State officers, and will sell half-fare tickets to members of the Legislature.

Pennsylvania.—This company's approximate statement for December shows, as compared with December, 1877, for all lines east of Pittsburgh and Erie:

A decrease in gross earnings of.....	\$236,006
An increase in expenses of.....	31,574

Net decrease.....\$207,670

For the twelve months ending Dec. 31, the same lines show, as compared with the same period in 1877:

An increase in gross earnings of.....	\$519,588
A decrease in expenses of.....	559,474

Net increase.....\$1,079,062

All lines west of Pittsburgh show for the year a deficiency in meeting all liabilities of \$44,674, being a gain of \$278,583 over the previous year.

The Altoona (Pa.) Mirror gives the following results of the November track inspection: "There are no returns from the New York Division save that it has been pronounced in better repair than either the Philadelphia, Middle or Pittsburgh divisions.

"The Philadelphia and Pittsburgh divisions have the same marks; no choice between them; both ahead of the Middle Division. No premium is given for superintendents' divisions.

"Best yard between Philadelphia and Pittsburgh—John G. Craig, Philadelphia yard.

"Best main line supervisor, excluding yards—John McGraw, Supervisor Division No. 2.

"Best supervisor on Middle Division—James Cullen, Supervisor Division No. 7.

"Best supervisor of Pittsburgh Division—F. Ehrenfeld, Supervisor Division No. 8.

"Best supervisor on branches—S. Dobson, Supervisor Division No. 18.

"One foreman on each supervisor's sub-division gets a premium. Foreman Michael Slattery, sub-division No. 7, at Cresson; William Leslie, foreman sub-division No. 17, at Sang Hollow, and J. C. Blair, foreman sub-division No. 28, at Latrobe, each received premiums for best track or most improvement of sub-divisions on the respective supervisor's division.

"Until the present year J. G. Craig, Supervisor division No. 1, Philadelphia yard, has had the best track on the entire main line; but this year yards were excluded from the competition and placed by themselves. The marks for yards are always higher than marks for the same condition of track on other divisions."

Peoria East-Bound Pool.—The east-bound freight pool from Peoria is said to have broken up, and the Commissioner, Mr. J. H. Stead, has resigned.

Philadelphia & Reading.—This company's statement for December, the first month of its fiscal year, is as follows:

	1878.	1877.
Gross receipts:		
Railroad traffic.....	\$810,891	\$1,208,435
Canal traffic.....	10,357	16,144
Steam colliers.....	40,020	63,004
Richmond coal barges.....	14,379	17,821
Total Railroad Co.....	\$881,656	\$1,304,004
Coal & Iron Co.....	570,051	795,839
Total.....	\$1,458,297	\$2,099,873
Traffic:		
Passengers carried.....	475,004	522,026
Tons merchandise.....	238,117	231,187
Tons coal.....	373,170	647,727
Tons coal on steam colliers.....	43,902	47,842
Tons coal mined:		
By Coal & Iron Co.....	214,046	361,829
By tenants.....	57,085	108,965
Total.....	271,731	470,794

There was a decrease in passenger traffic, but the great falling off in coal accounts for the loss of 32.4 per cent. in gross earnings of the Railroad Company.

The Reading (Pa.) Journal says: "All the arrangements have been made to exchange the bonds of the Berks County Railroad Company for the debenture bonds of the Reading Railroad Company. The plan is this: For every \$100 bond or bond of a larger amount of the Berks County Railroad, the Reading Railroad will give a bond for 60 per cent. of the amount of the Berks County Railroad bond, bearing interest from May 1, 1878, at the rate of 3 per cent. the first year, 4 the second year, 5 the third and 6 the fourth year, payable on May 1 and Dec. 1 of each year. This applies only to the bonds which have been pooled in the interest of the Reading Railroad Company."

The Berks County road, now known as the Reading & Lehigh, is leased to the Philadelphia & Reading Company. It

extends from Reading, Pa., to Slatington on the Lehigh Valley road, 41 miles, and was sold at sheriff's sale in December, 1874, the mortgage for \$1,500,000 remaining. The rental agreed upon was the net earnings of the road, and the present arrangement is probably intended to prevent a foreclosure by the bondholders.

Pittsburgh & Lake Erie.—The great land-slide at Edgeworth, which was nearly half a mile long, has been cleared away and regular trains between Pittsburgh and Youngstown will probably begin to run next week. There are to be two through passenger trains at first and three local trains between Pittsburgh and Beaver Falls.

At the recent annual meeting President Bennett reported that \$2,000,000 stock and \$2,000,000 bonds had been issued. The cost of the road was as follows:

Construction	\$2,540,818.38
Right of way and real estate	417,736.39
Equipment	434,437.12
Incidentals	19,500.97

Total (\$50,273 per mile).....\$3,418,552.84

The amount realized from the stock and bonds sold was \$3,485,553. The passenger and freight station and the engine-house at Pittsburgh are nearly completed. Passenger depots of suitable design have been erected at all other principal stations. A brick engine-house with iron turn-tables has been completed at Beaver Falls. The freight equipment has been completed and delivered. The locomotives and passenger equipment have been completed. Five of the locomotives have been delivered, and the remainder, together with the passenger cars, are ready for delivery. At the points shown to be weak by the recent storms, the road-bed has been altered to avoid further damage. It is this change which has delayed the final completion of the road.

Pittsburgh Southern.—The first train through from Pittsburgh to Washington, Pa., on this road entered Washington last week, and there was great rejoicing, a large crowd being gathered to meet it.

Pittsburgh, West Virginia & Southern.—This is the projected extension of the Pittsburgh Southern road into West Virginia. President G. P. Hays, of both companies, is now making an examination of the route and holding meetings along the line to work up local subscriptions. He has been generally very well received.

Portland & Ogdensburg, Vermont Division.—It is stated that the proposed compromise agreement has failed, the Fairbanks party withdrawing after the assent of a majority of the bondholders had been procured. The petition of the Receivers for leave to issue \$500,000 certificates, with which to raise money for repairs and improvements, was therefore to come up before the Court on Jan. 20. It will probably be urgently pressed now, and will be sharply contested by the representatives of the bondholders, who naturally object to so large an issue to take precedence of their own claims, and question its necessity.

Sabine Pass & Northwestern.—At the annual meeting recently, the stockholders voted to ratify the contract made with C. C. Campbell and W. B. Hotchkiss for the construction of the road. They are to build at once the section of the road from Lawrence, Tex., to Kaufman, 22 miles, and are also to begin work on the grading at the Sabine Pass, working thence northward.

St. Louis, Kansas & Arizona.—This company has filed articles of incorporation in Kansas, covering two lines which it purposes building. The first line starts from the Osage Division of the Missouri, Kansas & Texas, at the Missouri state line, and runs northwest to Topeka, about 100 miles. The other division starts from the same point and runs west by south across Kansas to a point on the western and near the southern boundary of the state, a distance of about 430 miles. The stock is fixed at \$10,000,000. A number of the incorporators are connected with the Missouri Pacific.

Southern Pacific.—The track on the Arizona Extension last week reached Mohawk Gap, 60 miles eastward from Yuma, and 80 miles beyond Adonde, the last point noted. East of Mohawk Gap the work is light and there is one tangent 50 miles long. Grading parties are at work all along the line as far as Maricopa Wells, 160 miles east of Yuma, and the company intends to reach that point in April.

Troy & Greenfield.—The Boston Advertiser says of the bill in equity filed by this company to redeem its road, now in possession of the State of Massachusetts: "The bill sets forth that on the 28th of April, 1862, an act was passed by the Legislature providing 'for the more speedy completion of the Troy & Greenfield Railroad and Hoosac Tunnel,' whereby provision was made for the surrender of the railroad, tunnel franchise and property of the Troy & Greenfield Railroad to the commonwealth under the mortgages, for the completion of the road and tunnel by the commonwealth, the act expressly providing that 'the right of redemption shall not be barred until ten years have elapsed after said road and tunnel are completed and the same open for use.' In pursuance of this act the Troy & Greenfield Railroad surrendered to the commonwealth its property, and the commonwealth has since remained in possession of it, and in receipt of the profits therefrom."

"The plaintiff alleges that the surrender was made at the special instance and request of the commonwealth, in order to enable the state to complete the road and tunnel in a more speedy manner than the commonwealth deemed that the plaintiff would be able to do, and it was the express consideration of the surrender that the road and tunnel should be held and completed by the commonwealth for the Troy & Greenfield Railroad Company, according to the then existing plans and locations of the railroad company, and that the total amount of all the expenditures and advances to be made by the commonwealth in the completion of the road and tunnel chargeable to the plaintiff should not, with the amount of state scrip already loaned to the road, exceed in amount \$2,000,000. It is further alleged that the plaintiff is desirous of redeeming the mortgaged property; that, according to the terms of the surrender, the total amount of all the expenditures and advances to be made by the commonwealth in the completion of the road and tunnel chargeable to the plaintiff should not exceed \$2,000,000, exclusive of \$200,000 advanced to purchase the Southern Vermont Railroad, and the total amount of such expenditures and advances chargeable to the plaintiff were fixed and liquidated at that amount; yet from responses made by the Treasurer of the commonwealth to demands made by the plaintiff it appears that the net cost of the railroad and tunnel to the commonwealth is \$18,854,034.57, and the Treasurer expressly declines to agree with the plaintiff as to the sum due and to be paid for the redemption of the property. It is further alleged that even if the commonwealth is entitled to recover for all reasonable repairs and improvements made by the state in completing the road and tunnel before the right of redemption can be exercised, that the expenditures and loans made by the commonwealth in excess of \$2,000,000 in completing the road and tunnel were not made for reasonable repairs and improvements, and that the proper charges against the plaintiff for the completion of the road and tunnel, and for reasonable repairs and improvements, in accordance with the act of 1862 and the terms of surrender, would not, with the amount of loans previously made, exceed the sum of \$2,000,000 exclusive of the amount advanced for the Southern Vermont Railroad; and that a proper deduction from the amount expended by the commonwealth of all useless, wasteful and unnecessary expenditures would reduce the amount due to the commonwealth as mortgagees for all expenditures made on account of the road and tunnel to a sum less than \$2,000,000. The plaintiff being unable to agree with the Treasurer as to the sum due by the plaintiff under the mortgages, brought this bill in equity to redeem the road and tunnel, asking for an account, and that the plaintiff may redeem the mortgaged property upon payment of whatever may be found due on the mortgages. The bill sets forth the claim of the plaintiff at length, and a large number of acts, mortgages, deeds and other papers are annexed. Counsel appearing for the plaintiff are E. R. Hoar and D. W. Gooch, of Boston; Joseph H. Choate, of New York, and John C. Bullitt, of Philadelphia. "It is stated that a written contract has been made with one of the wealthiest banking houses in the country, by which the necessary funds will be secured for a tender when the amount to be paid has been judicially determined."

Utah Southern Extension.—This company has been organized to extend the Utah Southern road from Chicken Creek, Juab County, Utah, through the Sevier Pass and thence southward to Millford in Beaver County, with a branch from a point near Millford to Frisco, about 130 miles of road in all. The capital stock is fixed at \$1,300,000.

Victoria.—At the annual meeting in Toronto, Ont., Jan. 15, the President reported the completion of the road to Halliburton in November, also its acceptance, and the prompt payment of subsidy by the government. In the section north of Kinnmount there are 24,500 cubic yards of rock work, and 2,935 lineal feet of bridging and trestling; 11 miles of this section are laid with steel rails. The course of the road for 14 miles lies through free grant territory, and the total mileage north of Lindsay is 55½ miles. The traffic of the line shows a steady increase, and the carriage of square timber, lumber, railway ties, and black birch logs is an important business for this road. A statement of working of the Kinnmount to Lindsay section, shows that after paying working expenses and for new sidings, enough remained to pay full rate of interest on the liability of that section of the railway. A branch six miles long to the Snowden Mine is to be built by parties interested in that mine.

Western Maryland.—The Baltimore Gazette of Jan. 29 says: "The holders of the second preferred bonds of the Western Maryland Railroad met yesterday and considered the proposition submitted to them by the directors of the road in reference to a settlement of impending difficulties between the company and the holders of this class of bonds. The proposition, which is said to be in a rather indefinite shape as yet, provides for the funding of the four years' back interest due on the second preferred bonds, the payment of interest on both the bonds and funded coupons, and the fixing of a day for the redemption of these coupons. There was a good representation of resident bondholders present at the meeting, though, in the absence of some of the heavy bondholders from the counties, nothing definite was done. Before action on the proposition, the largest holders of the preferred bonds throughout the state will be consulted, and should the settlement proposed meet with general approval then a committee from the bondholders will be appointed to meet the finance committee of the road to arrange details. According to the latest statement of the Treasurer of the road there will be a balance over expenses this year of about \$80,000, which will be sufficient to pay the interest proposed on the bonds and funded coupons and at the same time create a sinking fund for the redemption of the coupons. The payment of interest on the first mortgage has already begun and the prospects of the company being able to pay on the second preferred as proposed, are so flattering that an early settlement of impending difficulties is looked for. The day for a hearing in the foreclosure suit has been fixed for the third Monday in March, though it is believed everything will be arranged before that time."

Yadkin Valley.—It is proposed to build a railroad through the valley of the Yadkin River in North Carolina, from Patterson's Factory in Caldwell County east and south to a connection with the North Carolina road. The state is asked to give convict labor in aid of the road, which will be some 75 miles long.

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Connecticut River.

This company owns a line from Springfield, Mass., northward through the Connecticut Valley to South Vernon, 50 miles, with branches from Chicopee Junction to Chicopee Falls, 2.35 mile, and from Mt. Tom to Easthampton, 3.5 miles; it leases the Ashuelot road, from South Vernon to Keene, N. H., making 55.85 miles owned, and 79.60 worked. The report is for the year ending Sept. 30, 1878.

The general account is as follows:

Stock (\$37,001 per mile).....	\$2,100,000.00
Notes and accounts payable.....	361,201.97
Surplus.....	578,880.75
Total.....	\$3,040,148.74

Road and equipment (\$47,233 per mile).....\$2,637,976.52
Other investments.....102,127.32
Cash and cash assets.....300,044.90

Total.....\$3,040,148.74

The funded debt of \$250,000 fell due in September last, and was paid off, so that the company has now no debt of that kind.

The traffic for the year was as follows:

	1877-78.	1876-77.	Inc. or Dec.	P. c.
Train mileage.....	377,739	342,710	I.	35.029
Passenger mileage.....	946,900	896,748	I.	50.152
Passenger mileage.....	9,754,529	9,777,284	D.	22.755
Tons freight carried.....	322,900	292,029	I.	30.871
Tonnage mileage.....	7,117,026	6,858,585	I.	359.041
Earn. per train mile.....	155.0 cts.	171.0 cts.	D.	10.9 cts.
Earn. pr. pass. pr. mile.....	54.5 "	60.6 "	D.	6.1 "
Earn. per ton per mile.....	4.0 "	4.0 "		

The average cost of locomotive service was 10 cents per mile run with coal, and 14.3 cents per mile with wood. Car repairs cost 7.6 cents per train mile, and maintenance of way 27.4 cents.

The earnings for the year were as follows:

	1877-78.	1876-77.	Inc. or Dec.	P. c.
Passengers.....	\$207,841.51	\$203,551.57	I.	\$4,289.94
Freight.....	283,030.04	274,476.98	I.	8,553.06
Mails and express.....	24,908.04	24,105.91	I.	742.13
Rents, etc.....	8,894.91	11,108.17	D.	2,243.26
Total.....	\$584,070.50	\$573,302.63	I.	\$11,367.87
Expenses.....	385,635.99	371,371.36	I.	14,264.63
Net earnings.....	\$198,434.51	\$201,931.27	D.	\$2,896.76
Gross earn. pr. mile.....	7.345.11	8.632.78	D.	1.287.67
Net.....	2,506.84	3,040.08	D.	533.24
Per cent. of exps.....	65.96	64.78	I.	1.18

The Ashuelot road was worked for only a little over five

months in 1876-77, which accounts for the decrease in earnings per mile. The income account was as follows:

Net earnings.....	\$198,434.51
Accretion from the sinking fund.....	10,883.15
Interest received.....	3,883.12
Total.....	\$213,200.78
Ashuelot R. R. contract.....	\$14,114.45
Interest paid.....	29,139.25
Dividends, 8 per cent.....	168,000.00
	211,253.70

Surplus for the year.....\$8,547.08
Surplus Sept. 30, 1877.....\$561,965.23
Changes by profit and loss entries for year.....8,974.44

570,339.67

Surplus Sept. 30, 1878.....\$578,880.75

The Ashuelot lease has been successful so far. The road is now in good order, and eight miles have been laid with steel. On the line owned, 500 tons of steel rails and 25,978 ties have been used in renewals; 79.6 per cent. of the whole track is now laid with steel. The White Mountains fast train was continued last year, with increased success.

Dakota Southern.

This company operates a line from Sioux City, Ia., to Yankton, Dakota, 61 miles, and it leases the Sioux City & Pembina road, which, at the beginning of the year was open from Davis Junction to Portlandville, 17 miles; on Nov. 1 to Calliope, 17 miles further, and just at the close of the year to Beloit, 54 miles from Davis Junction. The company makes the following statements for the year ending Dec. 31, 1878:

	1878.	1877.	Inc. or Dec.	P. c.
Passenger carried.....	22,213	21,138	I.	1,075
Passenger mileage.....	1,012,631	1,050,379	D.	37,748
Tons freight carried.....	76,590	48,503	I.	27,997
Tonnage mileage.....	3,702,371	2,412,298	I.	1,290,103

The earnings for the year were as follows:

	1878.	1877.	Inc. or Dec.	P. c.
Passenger.....	\$51,565.93	\$60,509.28	D.	\$8,943.35
Freight.....	172,974.33	137,428.10	I.	35,546.23
Express, mail, etc.....	9,760.11	8,604.48	I.	1,155.63
Total.....	\$234,300.37	\$206,541.86	I.	\$27,758.51
Expenses.....	120,761.17	106,861.19	I.	\$13,899.98
Net earn.....	\$113,539.20	\$99,680.67	I.	\$13,858.53

	1878.	1877.	Inc. or Dec.	P. c.
Gross earn. per mile.....	2,892.60	2,647.97	I.	244.63
Net earn. per mile.....	1,401.73	1,277.57	I.	124.16
Per cent. of expenses.....	51.50	51.75	D.	0.25

The earnings have shown a gradual and steady increase for the last five years. A considerable traffic is expected from the extension of the leased line.

Wilmington & Weldon.

This company owns a line from Wilmington, N. C., northward to Weldon, 161.25 miles, with a branch from Rocky Mount to Tarboro, 17.75 miles, making 179 miles in all. For several years it was leased to the Wilmington, Columbia & Augusta, but that company having defaulted on the rental, the Wilmington and Weldon resumed possession April 13, 1878. The present report is for the year ending Sept. 30, 1878, and is the 43d annual report of the company. The equipment consists of 29 locomotives; 3 parlor, 19 passenger, 1 postal and 9 baggage, mail and express cars; 221 box and 129 platform cars; 1 paymaster's and 20 gravel cars.

The capital account is as follows:

Stock (\$8,135 per mile).....	\$1,450,200.00
Bonds (\$9,045 per mile).....	1,619,100.00
Floating debt.....	52,131.73
Profit and loss.....	315,434.47
Total (\$19,234 per mile).....	\$3,442,866.20

Road and equipment (\$18,661 per mile).....\$3,340,365.25

Stocks owned.....13,900.00

Assets, cash and receivables.....88,600.95

3,442,866.20

The annual interest charge on the bonded debt is \$106,850, or \$597 per mile. There was no change in stock or bonds during the year.

The earnings for the year were as follows:

	1877-78.	1876-77.	Inc. or Dec.	P. c.
Passengers.....	\$171,708.72	\$160,861.07	I.	\$10,847.65
Freight.....	274,480.19	341,443.30	D.	\$66,963.10
Express, mails, etc.....	41,020.45	46,157.65	D.	4,537.20
Total.....	\$487,219.36	\$548,462.11	D.	\$60,942.75
Working expenses.....	267,380.35	340,107.70	D.	72,727.35
Net earnings.....	\$220,439.01	\$208,354.41	I.	\$12,074.60

	1878.	1877.	Inc. or Dec.	P. c.
Gross earn. per mile.....	2,725.22	3,064.03	D.	338.81
Net.....	1,231.43	1,103.99	I.	67.44
Per cent. of expenses.....	54.83	72.10	D.	7.27

In addition to working expenses, there were extraordinary expenses amounting to \$44,781.28, of which \$33,491.17 were paid for new rails used in previous years, and \$11,290.11 for improvement and straightening of the road at Quincey Creek.

The income account was as follows:

Assets, Sept. 30, 1877.....	\$137,884.02
Gross earnings.....	487,815.36
Interest, sale of land, etc.....	632.80
Total.....	\$626,332.84

Working and extraordinary expenses.....\$512,170.63

Interest.....110,606.58

Real estate and improvements.....1,748.02

Old accounts charged off.....19,881.48

Reduction of floating debt.....93,834.58

537,731.80

Assets, Sept. 30, 1878.....\$88,600.95

The loss in earnings was chiefly in through freight, and was largely due to diversion of business in consequence of the destruction of the Weldon bridge.

The locomotive mileage was as follows:

	1877-78.	1876-77.	Inc. or Dec.	P. c.
Passenger.....	229,197	225,704	I.	3,493
Freight.....	177,080	205,436	D.	28,356
Service.....	19,632	30,632	D.	11,000
Switching.....	32,251	33,173	D.	922
Total.....	457,590	495,005	D.	37,445
Cost per mile.....	12.53 cts.	12.15 cts.	I.	0.38 ct.

During the year there were used in renewals 700 tons steel rails, 60,905 ties and 172,764 feet of trestle timber. The new culvert and reduction of grade at Quincey Creek are completed, and make it possible for the engines to haul five more freight cars than formerly. New warehouses have been built at Halifax and Magnolia.

The separation from the Wilmington, Columbia & Augusta was effected without difficulty, the accounts having been always kept separately.